



Forest communities and the marketing of lesser-known species from Mesoamerica

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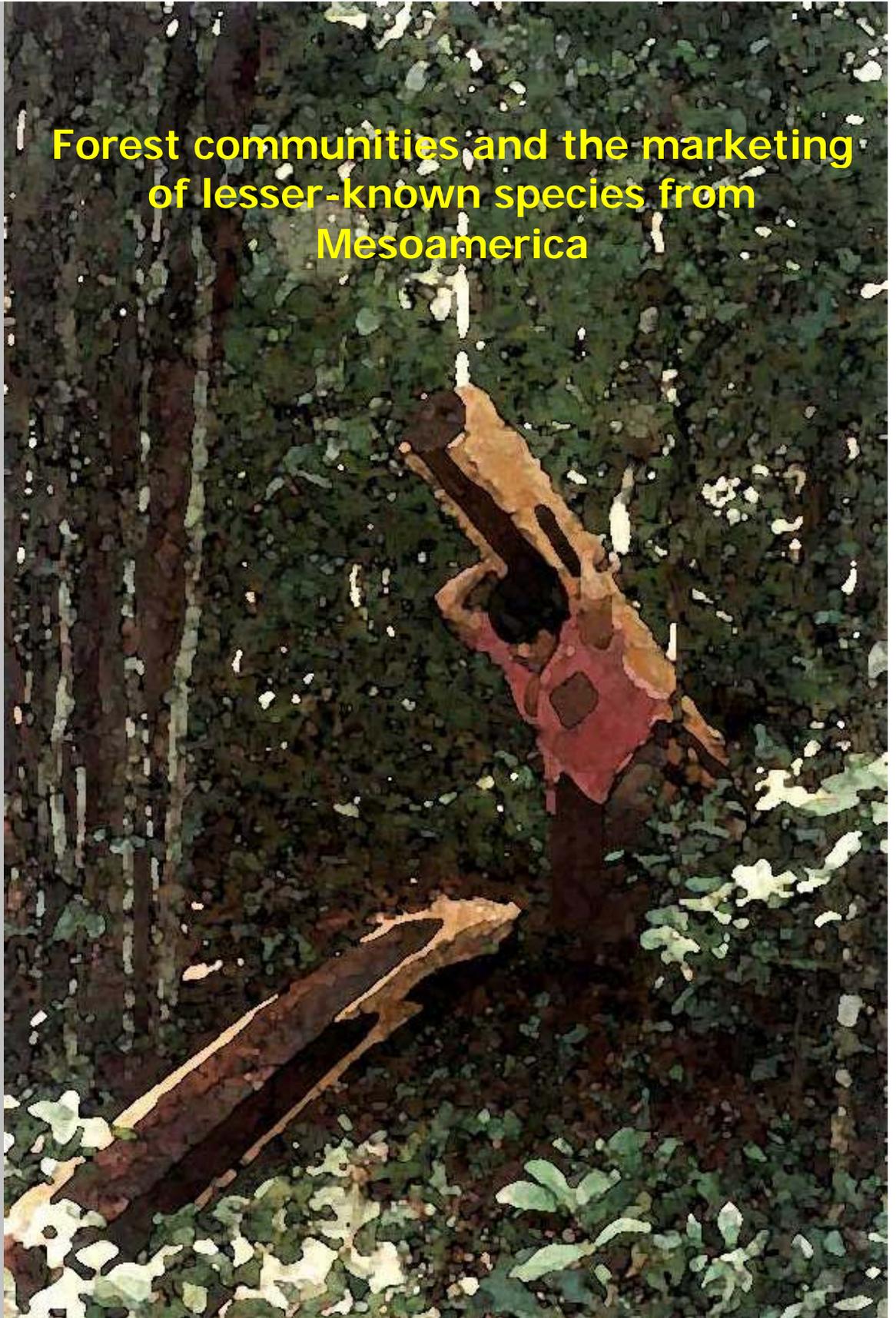
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To our children:

Mario, Alfredo, María Fernanda, Manuel, Spencer, Grecia María,
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ABBREVIATIONS

AFE-COHDEFOR	Administración Forestal Estatal – Corporación Hondureña de Desarrollo Forestal (Honduran Forest Service)
AHEC	American Hardwood Export Council
AMACUP	Asociación Mexicana de Artes y Culturas Populares (a mexican NGO that promotes handicrafts)
BF	Board feet*
CCF	Cámara Costarricense Forestal
CECADI	Centro de Capacitación y Desarrollo Industrial (a Mexican LUS promotion center)
COATLAHL	Cooperativa Regional Agroforestal, Colón, Atlántida, Honduras, Ltda. (Honduran group of forest operations)
CONAP	Consejo Nacional de Áreas Protegidas (Guatemalan protected areas administration)
CUPROFOR	Centro de Utilización y Promoción de Productos Forestales (Honduran timber research and promotion center)
DBH	Diameter at breast height
FADCANIC	Fundación para la Autonomía y el Desarrollo de la Costa Atlántica de Nicaragua (Nicaraguan NGO)
FPL	USDA/FS Forest Products Laboratory
FSC	Forest Stewardship Council
FYDEP	Empresa Nacional de Fomento y Desarrollo Económico de El Petén (former administration of Petén forests)
INAFOR	Instituto Nacional Forestal (Nicaraguan forest service)
LKS	Lesser-known species
LUS	Lesser-used species
MARENA	Ministerio del Ambiente y los Recursos Naturales (Nicaragua)
MDF	Medium density fiberboard*
MIQRO	Maderas Industrializadas de Quintana Roo (mexican plywood company)

* See also glossary (Appendix I).

NHLA	National Hardwood Lumber Association
NPV	Fundación Naturaleza para la Vida (Guatemalan technical support organization)
PIQRO	Recubrimientos y Pisos de Quintana Roo (Mexican flooring company)
RAAN	Región Autónoma del Atlántico Norte (Nicaragua)
RAAS	Región Autónoma del Atlántico Sur (Nicaragua)
RBM	Reserva de la Biosfera Maya (Guatemala)
SSF	Sistema Social Forestal (a Honduran social forestry program)
USAID	United States Agency for International Development
USDA/FS	United States Department of Agriculture/ Forest Service
WWF	World Wildlife Fund/ World Wide Fund for Nature

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Over the course of the study, we had the opportunity to interview a large number of people connected to the forest sector in Guatemala, Honduras, Mexico and Nicaragua: forest community members, forest extension workers, government officials, researchers, businessmen, forestry workers, guild members, collaborators from non-governmental organizations and the final consumers. The information gathered during these interviews is the foundation of this study. We would like to acknowledge the enthusiasm and concern demonstrated in responding to our questions, and recognize the desire of all contributors to aid in the development of the forestry-wood products sector in their regions.

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EXECUTIVE SUMMARY

Introduction

The first officially recognized community forestry operations in Mesoamerica began more than fifty years ago. Since then, their number has grown steadily due in part to their ability to resolve land use problems in regions of recent colonization. These operations have also helped reduce conversion of tropical forests to agricultural and grazing lands and, in many cases, substantially improved the quality of forest management, thus reducing over exploitation of the most valuable commercial species. Community forestry operations were also among the first worldwide to receive recognition for good forest management based on third party review (i.e. Forest Stewardship Council [FSC] certification).

In spite of these successes, community forestry operations¹ must confront a myriad of challenges over the next ten years if they are to consolidate their gains. A major challenge is the need to increase income from forest management operations as a way to maintain interest of community members in community forestry as an alternative to clearing forests for agricultural and animal husbandry uses.

A promising option to increase income from community forestry management is to increase use of lesser-used hardwood species.² While traditional commercial species, such as **mahogany** (*Swietenia macrophylla*), have been overexploited through the years and actually decreased in commercial importance in many forestry operations, numerous other species are currently underutilized. These species represent significant income potential for forest operations. Many operations have already been successful in using these species, thereby increasing incomes and, in some cases, improving forest management.

The difficulties encountered in trying to promote and sell lesser-used species are more serious than simply buyer reluctance to purchase unfamiliar wood. One of the most serious challenges facing community forestry operations involves learning and adhering to basic business practices, such as providing buyers consistent product quality and quantity, and reliable and timely deliveries. With free trade, community forestry operations have to compete more and more with large Chilean, Bolivian, Brazilian and Malaysian consortiums, many of which produce as individual companies volumes equal to that of an entire region in Mesoamerica.

¹ Refer to the glossary for a definition of “community forestry operations”.

² Lesser-used or lesser-known species may be defined as species whose current commercial demand is below their forest production potential (see also glossary).

Regional businesses that buy lumber from community operations are especially important for increasing utilization and sales of lesser-used species. Their proximity offers advantages in terms of costs, face-to-face communication, ability to control order fulfillment, and understanding of the production context. These companies also face growing external competition in their traditional markets. These facts lead to the necessity of analyzing regional production chains when promoting lesser-used species.

Methodological approach

This study uses a global “conceptual” approach to develop recommendations. It analyzes current status and trends of community forestry operations, regional production chains, and regional and national markets. It also describes opportunities and limitations for marketing lesser-used species, and evaluates previous promotion experiences.

Four regions with predominantly community forestry schemes are included in this study: the Reserva de la Biósfera Maya (RBM, Guatemala), the Región Forestal Atlántida (Honduras), the state of Quintana Roo (Mexico) and the Región Autónoma del Atlántico Norte (RAAN, Nicaragua). A wide range of people connected to forest production and wood processing were informally interviewed and results summarized for this report.³

Status and trends of community forestry operations

Tropical broadleaved forests cover more than 7.5 million hectares⁴ in the four regions included in this study. Timber extraction is officially permitted in approximately 1.2 million hectares, of which more than 90% is controlled by community operations. Depending on a variety of factors, the

total amount of land allocated to community forestry could increase up to 400,000 hectares within the next ten years. [Chapter 2.1].

Potential annual timber harvest of broad-leaved species in the four regions totals about 630,000 m³, including a little more than 30,000 m³ of mahogany (*Swietenia macrophylla*). This is relatively small by international standards, but represents an important resource in regional terms. [Chapter 2.2]

There are more than 150 community forestry operations located in the regions studied. Significant differences exist between these operations, both in terms of their use of the forest as a resource and in the actual structure and practices of that use. For example, some are sophisticated enough to control extraction and sawing of their own wood, while many others are still formalizing themselves as organizations, and depend upon the actions and equipment of external actors, thereby deriving reduced benefits from their forest practices. [Chapter 3.3]

Clear differences also exist in the socio-political setting of these forestry operations, both in their normative aspects (e.g. by-laws and regulations) and their institutional-operational aspects (e.g. characteristics of technical assistance and capacity for control). For example, in Petén, Guatemala, a balanced division of labor (i.e. planning, implementing, and enforcement functions) among regional players has been established. This encourages non-bureaucratic forest production, while at the same time maintaining adequate control over forest extraction and forest conversion. In contrast, forest institutions in the Atlántida have very bureaucratic, centralized procedures for extraction permits, and while at the same time having a weak grip on regional forest problems. In Quintana Roo and the Atlántida regions, where community forestry was established more than two decades ago, diverse legal changes in the privatization of the forests have destabilized some elements of community forestry. [Chapter 3.2]

³ Field work for this study was carried out in 1999 and 2000. Some relevant changes have occurred since then, especially in Guatemala, where the new government has brought new policies into place.

⁴ One hectare equals 2.471 acres; a log scale cubic meter approximates .221 Scribner MBF; a sawn cubic meter equals .424 MBF.

Status and trends of local and regional production chains

A significant portion of the primary processing infrastructure in the regions was established during the industrial growth period of the sixties and seventies. Today, each region has between five and 12 sawmills (portable sawmills not included) with annual production ranging between 4,000 to 20,000 m³ each. There are plywood plants in all regions, but only in the RAAN does production approach installed capacity. The RAAN is also the only region studied where the amount of extraction and saw-milling equipment has increased in the last few years (i.e. portable sawmills).

Secondary processing operations developed differently in each of the regions studied: In Quintana Roo and Petén, several companies integrated further value-added production steps with their primary processing operations. In the Atlántida, a large number of independent secondary companies were set up in the seventies and eighties. Today, this is the only region that has a significant number and diversity of secondary processing companies (mostly in the furniture sector). In Quintana Roo, many secondary processing companies closed over the last twenty years; however, two flooring companies, both oriented towards the export market, opened in the nineties. In Petén, the few remaining secondary manufacturing companies work only intermittently, but a group of flooring companies established in a neighboring region are becoming important buyers of Petén wood. In the RAAN, a large sawmill has started to manufacture flooring products. [Chapters 1.2 and 4.1]

The regional production chains existing in the sixties and seventies were simple: Private businessmen with legal access to forest exploitation would set up extraction operations and primary processing lines to sell logs or sawn timber to national or international customers. Forest management quality was low.

Since then, several changes have affected these production chains and commercialization of lesser-used species:

- **Colonization** - The significant increase in the rural population and subsequent deforestation in the study regions has meant a gradual reduction in potential timber supply. [Chapter 1.2]
- **Impacts of Community Forestry** - The creation of community forestry operations has reduced negative ecological effects of colonization and dramatically slowed indiscriminate exploitation of woodlands. [Chapter 1.2] At the same time, community forestry operations radically changed existing production chains. Many private companies had to give up control over forest production and extraction, and sometimes sawing, and instead were forced to negotiate with community operations for logs or sawn timber. Community operations also adopted better forest practices that reduced the supply of highly commercial woods (e.g. mahogany). [Chapters 3.1, 3.3 y 3.4]
- **Modernization** - New highways and increases in regional demand have stimulated external companies to start businesses in the regions studied that out-compete and displace regional products (especially furniture and building materials). With the increase in free trade between nations, this trend is expected to continue. [Chapter 4.1 y 5.1]
- **Forestry and Land Use Policies** - Forestry and land use policies have changed frequently and often unexpectedly. [Chapter 3.2]

Also, forest operations and processing companies have not established stable relationships, which is reflected in the highly unstable nature of production chains in the regions studied. [Chapter 4]

Status and trends of regional and national markets

In general, regional players in the forestry sector have not adjusted to the changes described above or been able to take advantage of modernization and increased commerce. Due to these varied prob-

lems, consumption of lesser-used species for the last two decades has actually declined. [Chapter 5.1]

Despite this overall decline, lesser-used species have managed to maintain a strong presence in many regional and national markets. For example, lower- and medium- density woods are used extensively in furniture production in the Atlántida, occupy market niches in furniture production in Central Mexico, and are used in the production of plywood in the RAAN, Petén and Quintana Roo. Higher-density woods are increasingly used for flooring in Quintana Roo, Guatemala, and central Nicaragua, but have lost market share in other uses (e.g. piers, construction, and railroad ties). [Chapter 5]

An important wood products technological trend in the regions is the growing use of composite panels in furniture production, especially medium-density fiberboard (MDF). This means that furniture makers will need increasing supplies of decorative veneers (to cover the MDF-boards). At the moment, decorative veneers using lesser-used woods are not produced in any of the regions, thus excluding these species from this attractive, growing market segment.

Limiting factors for use of lesser-used species in regional production chains

Various factors limit increased use of lesser-used species in regional production chains:

- Managerial Capacity - With the exception of a few large companies, there is **limited managerial capacity** in community forestry operations and private processing companies. The result is weak customer service, unreliable product quantities and quality, and uncertain delivery times. Few companies appear to have the capacity to develop long-term business strategies (e.g. to defend their current markets). [Chapter 6.4] The chances of influencing the managerial capacity of community operations with conventional technical assistance and training programs

are limited due to organizational, political, and social issues. For example, poorly stacked and stored wood is not necessarily the result of lack of knowledge, but often reflects the inability of sawmill foremen to impose changes due to “structurally” weak leadership (i.e. high turnover of leaders, key positions filled based on a ascribed person’s status in the community rather than technical skills or achievements, and the fact that both foremen and workers have the same formal status in the community). [Chapter 6.2]

- Relations Between Community Forestry Operations and Private Industry - Relationships between community forestry operations and private industry remain poor, and even worsen, as both entities struggle to control extraction and sawing, often attempting to fill positions in the production and distribution chain about which they may know very little. This creates an asymmetrical situation: Community forestry operations with greater volumes of mahogany and good forest management have managed to establish extraction and sawing procedures for this wood, but find it difficult to market lesser-used species. On the other hand, private companies, which have greater ability to market lesser-used species buy timber from sources with poor forest management. [Chapter 6.3]
- Regulation and Control of Forest Production - Clear weaknesses are evident in the state regulation of forest production, which, for example, often paralyzes the legal timber market in the Atlántida. [Chapter 3.2] Also, a weak judicial system leads to a general situation of impunity. Currently, the validity of agreements made at many different levels (e.g. between community members or between companies) is greatly reduced. [Chapter 6.3 y 6.4] Moreover, industrial chambers and other institutions in charge of industrial promotion lack funding and adequate policies. They also appear to mainly consider the interests of large export-oriented companies, that normally process pine.

Lesser-used species marketing and promotion experiences

In the study regions, there have been many experiences in the promotion of lesser used species:

- a) Continuing work begun in the United States and Europe, wood research centers in Mexico and Central America have described the physical, mechanical and aesthetic characteristics of several regional lesser-known species. While this approach has increased knowledge of lesser-known species, it has proven insufficient as a stand-alone measure to increase their use. Today, lack of knowledge about wood characteristics is no longer the central problem, with the exception of noticeable information gaps, especially in the Atlántida. Consequently, many regional wood research centers have strong funding problems.
- b) Several initiatives have dealt with identification of export opportunities, especially “green” markets. After almost ten years, results have been rather poor. In particular, lack of management capacity has inhibited formation of stable commercial relations with timber traders in the USA and Europe, who have started to import certified timber from private companies in Bolivia and Brazil. Today, very few community forestry operations are exporting directly to foreign markets.
- c) Several market research studies have been conducted, but no clear marketing concept has resulted, hence their impact has been reduced.
- d) Some promotional initiatives have targeted management capacity, and relations between community operations and private companies. Three general strategies have been used:
 - Improvement through organizational restructuring of operations
 - Establishment of specialized technical groups to take over some marketing functions, and act as communication and implementation

facilitators between forest operations and private industry.

- Discussions about division of labor between community operations and private companies (i.e. who controls what step in the production chain).

Although there are as yet few long-term experiences, it appears that these projects have a much clearer impact on marketing lesser-used species than those focused on basic technological research or export promotion.

- e) Experiences with vertical integration have been both negative and positive. Communities, technicians and donor organizations frequently favor vertical integration, although simpler and more effective ways to improve income may be available. Normally, vertical integration of forestry operations appears to be more successful at the log extraction level. There are fewer successes when efforts are made to integrate sawmill operations, and even fewer when secondary manufacturing is included. (It should be noted that vertical integration may make good sense for family-based businesses, such as small carpentry shops). [Chapter 8]

Recommended strategies

Promoting sales of lesser-used species does not necessarily make sense in all regions studied. Increasing use of lesser-used species in the RAAN, Nicaragua, could be counterproductive because of lack of legal or regulatory framework to encourage better management practices. The priority in this situation should be to establish appropriate forest management and land use policies.

Improved marketing of lesser-used species will most probably positively influence forest management in Petén (Guatemala), Atlántida (Honduras) and Quintana Roo (Mexico).

It is recommended that marketing and promotion of lesser-used species in Petén, Atlántida, and

Quintana Roo should emphasize strengthening regional production chains, and defending current markets. The following approaches are suggested:

- Improve managerial capacity of community forestry operations
- Improve the relationship between community forestry operations and private industry
- Increase marketing capacity of businesses
- Improve the quality of legal regulations
- Consolidate technical assistance in wood processing and marketing

Activities should focus on regional and national chains and markets, because it is here that the success or failure of community marketing efforts will be determined in the next ten years. This is not to completely discard overseas markets. Certainly, “green” (e.g. markets for certified products) are an attractive option. Nevertheless, it is important to be realistic. Today, less than five of the more than 150 community operations existing in the study regions have possibilities to successfully sell to these markets as direct exporters. Here, the most promising alternative is again to try to improve regional chains, leaving export tasks to private companies or to specialized non profit organizations and securing the flow through chains of custody.

Specific project recommendations

1. Improving management through a micro credit program - The primary recommendation for Quintana Roo and the Atlántida, and possibly Péten as well, is the establishment of a program to improve managerial capacity of community forestry operations and relationships with private industry. Three basic tools are suggested: Micro credits, technical assistance, and legal advice. The experience with “fondos de acopio”, a micro credit program in Quintana Roo, can be used (see box no. 38). The micro credits would be used to finance wood production. They would be conditioned on

improving community forestry operations, probably with help from technical assistance groups. Technical assistance groups could also help facilitate fulfilling timber orders and improving cooperation between community operations and private industry. Improving awareness of legal obligations should help trade partners adhere to established agreements.

2. Community forestry extraction methods and technology - Extraction technologies and methods are critical first steps in the production chain to make utilization of lesser-used species economic and environmentally-sustainable. Technologies and methods differ in each region, as does the type of assistance that may be needed. In the Atlántida, for example, the extraction process could be improved by introducing guides for chainsaw lumber production (Alaskan saws) and improving understanding of customer requirements. In Quintana Roo, extraction methods need to be explored that require lower initial investment and operating costs. This would make it easier for more community operations to take control of extraction operations.

3. Product development in the primary industry - In Péten, a mutually beneficial arrangement has been developed based on close cooperation between different community forestry operations and a private company. This situation increases capacity for technical innovations. Technical assistance could be offered for sawn wood products as well as for veneer. Support for development of decorative veneer capacity to broaden the product line is recommended (e.g. for use with MDF used in furniture production). Success would provide a model for other regions.

4. Promoting lumber trade: it is recommended to start discussing how to improve regional forest products trade. This is a political and a legal issue rather than a technical one. Therefore, *madereros* and lumber dealers must be involved in the discussions.

5. Secondary Industry Competitiveness -

The Atlántida region could lose a significant regional furniture industry within 10 years because of external competition. The objective in this case should be to improve competitiveness of local companies by assisting with product development, distribution channels, and marketing strategies. Small- to medium-size companies should be encouraged to pursue market niches that are not attractive to larger companies who import goods from outside the region (e.g. offer custom installation of doors and kitchens). These activities would be an important opportunity for CUPROFOR, the largest regional lesser-used species promotion center, to reorient its focus from basic research to marketing and promotion.

6. Marketing chainsawn lumber: a market survey and production tests for chainsawn and axe hewn lumber are recommended. This would provide a systematic marketing experience that would give some clues for later work.

7. Pilot production with lesser-used species: selected secondary processing companies should test lesser-used species in their regular production to determine problems and eventually starting using them on a regular basis.

8. Shared Development Goals - Community forestry operations, private businesses, and government regulatory and marketing bodies need to come together to define and pursue common goals. Government entities should consider a facilitative and cooperative approach, rather than one that is auto-

cratic and dictated to the parties concerned. The region of Petén is the most notable example of independent yet interrelated processes. Other regions could profit from these experiences. Many discussions are already taking place that could be used to facilitate agreement, including forest management certification, “industrial clusters”, and biological corridors.

9. Other recommendations include:

- Characterize basic properties and conduct industrial tests for selected species in Petén and Atlántida.
- Promote family-owned businesses that specialize in the utilization of residue that is currently left in the forest or discarded during manufacturing; processing ideas could come from linking end-uses of commercially valuable species, such as mahogany, with historic logging and processing practices.
- Conduct studies and trials to improve fungi and insect resistance of lesser-used species. The objective is to identify cost-effective, ecologically sound and non-hazardous treatments to prevent decay of light-weight logs and sawn timber;
- Conduct bench marking studies related to recovery for various lesser-used species and processing methods;
- Establish market monitoring systems and develop business strategies for specific groups of regional companies to maintain or to expand market share (e.g. small- and medium-size carpentry shops in the Atlántida region).

I INTRODUCTION

1.1 Conceptual approach

Over the last three decades, important steps have been taken towards more sustainable utilization of forest areas in Mesoamerica. With the granting of user rights to local communities or groups deriving from them, it has been possible to slow conversion of the forests and, at the same time, achieve considerable improvement in the quality of forest management and extraction activities. One indication of these improvements is the substantial number of operations certified by Forest Stewardship Council (FSC)-accredited organizations.

Despite their successes, community operations will have to confront diverse challenges over the next decade to consolidate their gains. Amongst these challenges is the need to increase income from forest management. Only in this way will it be possible to maintain community members' interest in forest management as an alternative to conversion, and subsequent agricultural and cattle-farming use of the land.

A promising option to increase income from forest management is to increase utilization of so-called lesser-known species. Whilst traditional commercial species, such as **mahogany** (*Swietenia macrophylla*) have been over-exploited for years and are no longer important commercially for many forestry operations, significant volumes of other species, which are currently under-utilized due to marketing difficulties, exist.

One advantage of this approach is that it is a model that has already been disseminated in Mesoamerica. Unlike non-timber products, which in practice have been developed only in communities which enjoy the attention of non-governmental organizations (NGOs) and government bodies, and the uncertain promise of selling environmental services (e.g. carbon sequestration credits), the utilization of lesser-known species already benefits a great number of communities.

Greater utilization of lesser-known species also encourages implementation of important silvicultural measures. For example, in Quintana Roo the larger clearings produced by greater utilization of lesser-known species has led to improved conditions for the growth of species that were previously overexploited (e.g. **mahogany**).

Lesser-known species around the world have been systematically promoted and introduced into markets for nearly a century, with some eventually becoming high-value species (e.g. **ramin**). The first approach to promotion was by wood technicians who described technical and aesthetic characteristics. Later, several organizations started active marketing efforts. In the USA, lesser-known species are promoted worldwide by such powerful organizations as the American Hardwood Export Council. Through skillful marketing efforts, Malaysia and other Southeast Asian countries have introduced **meranti** (*Shorea* spp.) and **rubbertree** wood (*Hevea brasiliensis*).

All these initiatives have a common set of denominators: The species being promoted are available in large quantities at attractive prices, and promotions and sales are supported by a strong internationally competitive service structure (e.g. orders are delivered when promised, grading is consistent, responsibility is accepted and refunds offered for errors or other problems, sales and manufacturing are responsive to customer needs, payment methods or timing are negotiated, etc.)

In Mesoamerica, conditions are different:

- Promotion of lesser-known species continues to be the almost exclusive concern of wood technology laboratories. Even if other organizations recognize the need to increase marketing and promotion, few ideas have come forth on how to proceed.
- Problems with the supply of lesser-known species in Mesoamerica are more serious than in other regions. Here, there are not the same large quantities of timber nor competitive prices on an international scale. The sales services of the majority of Mesoamerican companies also have serious weaknesses. These weaknesses are a reflection of limited capacity for marketing in particular and limited managerial skills in general.

Today, Mesoamerican forestry operations face competition from Bolivian and Brazilian concessions; just one of which could have a larger extraction area than a whole Mesoamerican region. Plywood producers face competition from Southeast Asian countries; and furniture makers can see Chinese furniture increasingly penetrating their markets. The result of all this is that instead of increasing, the quantities of lesser-known species utilized have decreased considerably.

This report contends that an approach that concentrates on technological aspects, and possibly identification of new markets, to promote lesser-known species is not likely to succeed. The problems that make marketing of lesser-known species in Mesoamerica so difficult go beyond an incomplete knowledge of the physical and mechanical properties of species, and the options

available for tackling the problems are much greater than just the technological description and testing of new species (e.g. the use of marketing approaches and techniques, new concepts and models of regional development, and experiences of other community organizations).

Therefore, a much broader approach to the problem of how to better market lesser-known species was taken for the present study. This approach considers the full range of possible inputs that may affect the problem, including technical, managerial, regulatory, and organizational aspects. The report begins with an analysis of the current situation and trends at the level of community operations, production chains, and markets. Based on this analysis, limitations and opportunities are derived to improve the marketing of lesser-known species, and experiences of different communities evaluated. The overall goal of this study is to develop recommendations about tools and strategies to improve marketing of lesser-known species coming from community management.

The study places special emphasis on the management capabilities of community forestry operations and the relationship these operations have with regional processing businesses. Community forestry operations were formed around such concepts as participation, empowerment, and sustainability, not concepts such as competitiveness, efficiency, and specialization. The need to improve marketing of lesser-known species could be a catalyst for community operations to discuss how these apparently conflicting sets of concepts can be integrated.

1.2 Study regions

Community forestry plays an important role in general land use in the four regions selected for this study.

- a) In the RBM (Petén), community forestry was established as the main model of land use only a decade ago. An exemplary division of labor has been established between different

- bodies with regulatory, operational and controlling/evaluating responsibilities, by building on pilot studies in the RBM itself and intelligently adapting experiences from other regions.
- b) In the Atlántida Region in Honduras, community forestry was set up as the dominant forest use almost thirty years ago, but the system still suffers from many deficiencies.
 - c) In Quintana Roo, Mexico, community forestry replaced the system of concessions twenty years ago. This region was the first to discuss social forestry as an aid to planning land use in large geographical spaces, as opposed to other perspectives which visualized social forestry principally as an instrument of social compensation. Some institutional and legal changes have weakened the consensus that initially supported community forestry.
 - d) In the Región Autónoma del Atlántico Norte (RAAN), Nicaragua, community forestry has been legally decreed, but is not established in practice. Forest communities exist, but as yet have not been able to take control of the forests. Clear political and operational support is needed.

The regions differ in their industrial infrastructure and regional markets: The Atlántida and Quintana Roo have important final markets, while the RBM/Petén and the RAAN/Nicaragua are situated far from them. The only region with a significant secondary processing industry is the Atlántida. In Quintana Roo and Petén, secondary processing capacity that existed fifteen years ago has almost completely disappeared, although some flooring manufacturers have emerged. The RAAN in Nicaragua as a region is just starting out, not only in relation to forest organization, but also industrial growth. Moreover, problems remain in the RAAN that are no longer critical in other regions (e.g. land ownership).

The regions chosen are not the only regions in Mesoamerica where community forestry is dominant. In Honduras, the majority of broad-leaved forests are utilized by community groups. Besides the Atlántida forest region, la Mosquitia

and the department of Olancho are also important. In Mexico, ejidos and indigenous communities control forest management in practically all regions (more than 80% of the national forested areas). In Nicaragua, all forests on the Atlantic Coast (RAAN and RAAS) are, de jure, under the control of indigenous communities or other community groups.

1.2.1 The Reserva de la Biosfera Maya (RBM) in the Petén, Guatemala

The RBM is located in the northern part of the department of Petén, occupying approximately 2.1 million hectares. The RBM constitutes the most extensive area of natural woodlands, grasslands and wetlands in Guatemala (see Map 2).

The colonization of the RBM has taken place at the same pace as in the Petén. This region has been exposed to fierce migratory pressure over the last four decades, increasing from a population of 25,000 people in 1960 to more than 525,000 at present. In the south of the Petén, the Guatemalan government conceded colonization in small properties; whereas the northern part of the department, the current RBM, was envisioned for forestry use, so no lands were distributed. Even so, colonization did not stop with the presence of the RBM: today, approximately 100,000 people live in this part of the Petén. Despite this, the conversion of woodlands in the RBM has been clearly less than in the south of the Petén. Although the population has continued to grow, it appears that migratory pressure towards the forest areas has diminished in recent years.

As a protected area, the RBM does not have large populations. Trade relations are with towns and cities located between 20 and 50 kilometers to the south, in particular Santa Elena/San Benito/Flores (approximately 120,000 inhabitants). None of these are important markets for finished wood products.

In the principal towns of the region, the infrastructure and services have improved considerably over the last ten years, unlike smaller villages

where people still lack water, drainage systems, and telephones. Over the last ten years though, significant efforts have been made to ensure that the population has access to medical services and primary education.

The north of the Petén has access to markets outside the region by two highways: One goes eastwards to Belize and the other to the southeast, reaching Rio Dulce and Guatemala City. Both highways have been greatly improved over the last ten years. The idea of building a bridge over the Usumacinta river has also been discussed, to connect the Petén with Mexico by highway, or

improve the road which crosses into Mexico a little further north at Tenosique. This would make the Petén less isolated, with corresponding good and bad effects. In Rio Dulce/Livingston there is a port.

Twenty years ago, the most common type of business was a sawmill with some extraction equipment, generally a small total investment if compared to the profit it made. More or less 40 sawmills existed. Since then, the number of businesses working in the forestry sector in the Petén has decreased due to both supply and market problems.

BOX I

The long and winding road to community forestry in the RBM

For decades, the forest reserve in the north of the Petén was the domain of private companies. During the sixties, seventies and eighties an important industrial infrastructure for timber was developed. However, forest management and extraction control systems were weak, which led to overexploitation of forests. Moreover, companies were incapable of containing growing migration and avoiding conversion of substantial forest areas. With growing concern for tropical rainforests in the eighties, this was a problem that had to be solved. In 1990, the *Consejo Nacional de Areas Protegidas* (CONAP) was set up to manage all protected areas in Guatemala and the RBM was decreed. At first, the CONAP encouraged a policy of total protection (zero extractions), which rapidly led to an industrial crisis in the region. Total protection could never be completely implemented because it presupposed institutional capacity of spatial control (for example, ability to slow down illegal timber extractions), which did not exist. This policy also led to confrontations and clash of interests with members of the army, who in some cases sabotaged CONAP's work. Therefore large-scale illegal logging was unleashed in the rainforests of the Petén for nearly half a decade.

This policy did not respond in any way to the problem of colonization in the RBM. From 1995 to 1997, invasions of protected areas occurred daily, leading to deforestation of 150,000 hectares. Faced with this reality, change was inevitable. Luckily, previous experiences existed (e.g. the communities of San Miguel and La Pasadita, which, with help from the project CATIE/OLAFO, had negotiated against great odds a communal concession in 1992), which enabled local actors to reformulate the concept of forestry. The change was implemented with exceptional intelligence and realism, resulting in a system of forest use (i.e. regulation, technical assistance, and participation of local communities) that is probably the best-organized and balanced in Mesoamerica. It is important to note that together with the community concessions, two concessions were awarded to private industry. These concessions have only a small risk of being invaded by colonists, because, as seen in Map 2, they are "protected" by the community concessions. This exemplifies how a geographic factor was used to encourage acceptance of community forestry.

The forest product companies that survived, currently six, are businesses that made significant investments and were highly integrated: They all have extraction equipment and a sawmill, three of them have a plywood line, and one has an excellent decorative veneer line (mostly mahogany). Each company can process an annual input of round wood between 10,000 and 30,000 m³. Two of these companies were able to establish important secondary processing lines: one for the production of doors and the other for flexible production of floors, doors, and prefabricated houses. Almost all have sales warehouses in Guatemala City. These secondary processing lines have worked intermittently over the last few years.

All of these companies are shadows of their former selves... large buildings with old machinery, often working at ten percent of capacity, sometimes closing temporarily. A firm that had 400 employees in its heyday now has less than 50, and the machinery is sized too large for the diameters of logs that now arrive at the plants, which increases costs and waste.

Micro and small carpentry shops⁵ exist in the larger towns, which supply regional markets: There are probably no more than eight small businesses in the region.

Some community operations installed their own sawmills after implementation of community forestry; in each case this was carried out with the help of development agency donations or long-term loans. Portable sawmills were also purchased. Two of three sawmills installed did not work due to errors in the purchasing of machinery or in the type of organizational structure chosen. Currently, some community operations are considering buying the remains of sawmills that closed a few years ago.

In summary, the industrial infrastructure is basically what remains from the period of industrialization in the seventies and eighties. Even though this infrastructure is not ideal for the forest's potential, and except in a few cases, has

not been maintained for about a decade, it still is important in regional terms and has potential for growth. In the case of the two companies that received forestry concessions, it is likely that investments will be made in their factories because the certainty of supply allows them to plan production more efficiently.

1.2.2 The Atlántida Forest Region - Honduras

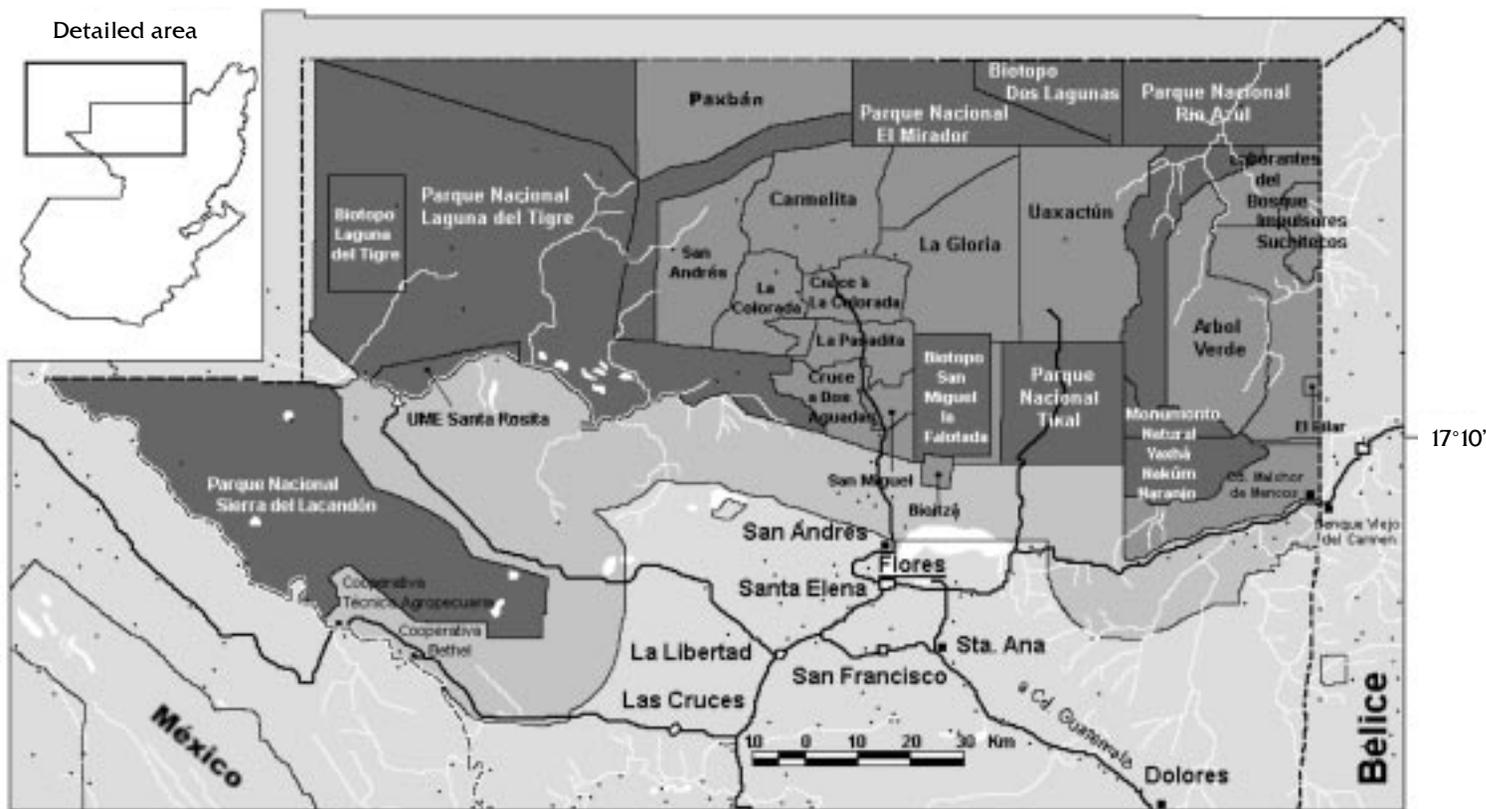
The Atlántida Forest Region covers a strip 40-80 kms wide which runs parallel to the northwest coast of Honduras (see Box 4). It consists of the departments of Atlántida, Colón, Islas de la Bahía, and part of Olancho and Yoro, covering a total area of 1,511,000 hectares. The region is mountainous. The three mountain ranges that traverse the region have determined to a great extent the form of occupation and land use. The largest forests are in these mountain ranges whereas the valleys have been turned over to other uses (bananas and palm oil amongst others). The precipitous mountains have led to a particular extraction system: Cutting logs into rough cants using chainsaws and subsequent transportation with mules (see chapter 3.3).

The agricultural frontier has continuously advanced since banana companies began to cut down forests in the valleys at the beginning of the xx century to expand their plantations. Beginning in the nineteen seventies, changes in land use increased due to the colonization of the region encouraged by the Honduran government. Farmers have penetrated the most easily accessible mountain sides, planting maize, beans, and semi-permanent crops, such as coffee, citric fruits, and sugar cane. The least accessible areas on the steepest slopes, are still covered by forest. Colonization of these areas increases every time a new highway is built, which is indicative of continuing migratory pressure.

⁵ For the purpose of the study, a micro business is defined as having less than 5 employees, a small business between 5 and 15, a medium business more than 15 and less than approximately 60, and a large business more than 60.

BOX 2

Petén, Guatemala



- National parks
 - Buffer Zone
 - Community and industrial concessions
 - International border
 - Main road
- The two industrial concessions are Paxban and La Gloria

Source: Based on International Travel Maps, Canada.

BOX 3

The rise of community forestry in the Atlántida/Honduras

The *Administración Forestal Estatal- Corporación Hondureña de Desarrollo Forestal* (AFE-COHDEFOR), this is, the Honduran Forest Administration, was set up in the seventies, as a “mixture” of state enterprise and development instrument. It had to take care of regulatory tasks, such as forest management, transportation of timber, forest extractions, and primary processing. At the same time, the program “Sistema Social Forestal” (SSF) was created. Its objective was the participation of rural population in forest management. The participation of peasant groups in forest management does not appear to have been seen as an instrument of land use planning, but rather a measure of social compensation. Despite this, the SSF is an important step towards forest community. In the Atlántida region, community extractions started with the *Cooperativa Agroforestal Colón Atlántida Limitada* (COATLAHL), which for a long time supplied industry in San Pedro Sula. The state ownership of forest lands, the operational mandate of COHDEFOR to carry out extractions and primary

processing, and partial assignment of these two tasks to community groups, are reasons why the private industry in the Atlántida never developed strategies of vertical integration, such as those which exist in the other three regions (extraction-sawing-secondary processing), and why they concentrated on secondary processing. It can be said from the development reached by the secondary industry, that this division of labour worked quite well. Today it is clear that mahogany has been overused for many years. In 1992, a new law was passed with the objective of granting extraction rights once again to private companies. In the Atlántida, this scheme was not successful. The groups there continued to work as before, and, on the contrary, gained in strength due to the activities of a project of technical cooperation between Honduras and Canada. A new law is being currently worked on which fully takes into account the work of community groups.

The region’s most important trade centers are the cities of La Ceiba (approximately 90,000 inhabitants) and San Pedro Sula, the second largest city in Honduras (500,000 inhabitants). Both cities represent important end-markets for wood products. La Ceiba supplies the islands of la Bahía, which have significant demand for furniture and timber for construction due to their growth as tourist centers.

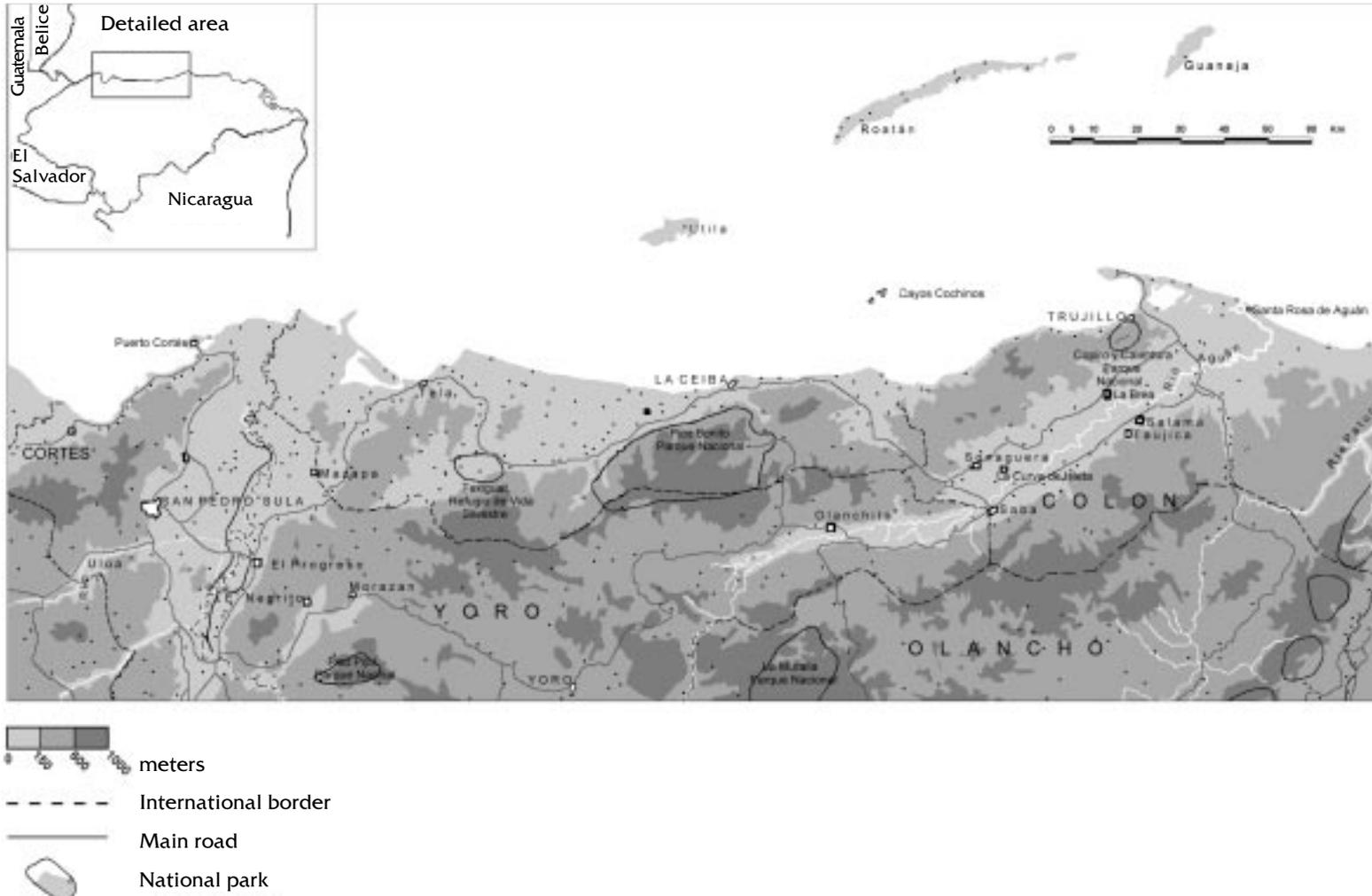
A good road network connects the region’s major cities through the valleys (San Pedro Sula, Tela, La Ceiba, Olanchito and Bonito Oriental). However, very little infrastructure has been established within the mountainous regions, a measure used expressly to reduce the possibilities of colonization and changes in land use. Communi-

ties with groups that have licenses for timber extraction are generally found between the highway and the mountains, or are hidden away in the mountains. The Atlántida has very good connections with other markets (e.g. highway to Tegucigalpa and Honduras’ seaport, which is Puerto Cortés).

The region has great potential for use of hardwoods, not only because of the geographic proximity of the forests to important centers of consumption (the cities mentioned), but also because of the rapid growth of these cities. The familiarity of consumers in San Pedro Sula and La Ceiba with lesser-known species is apparent, as are the prejudices they have against pine for furniture.

BOX 4

Atlántida, Honduras



Source: Based on International Travel Maps, Canada.

There are currently 55 forestry operations in the region that produce motorsawn lumber. There are also a large number of illegal sawyers. Both groups sell to approximately 20 *madereros*, who themselves supply 35 small businesses, 14 medium-sized businesses, and five large businesses in the region, which by Central American standards is a significant cluster. Most of the small and medium-sized companies, and all of the large firms, are in San Pedro Sula. The majority of the companies are involved in furniture production. One company produces truck beds (see Chapter 8.1.3). It is important to stress the fact that the large companies do not get all of their supply from the region. The majority of their supply comes from la Mosquitia, where there are still significant volumes of **mahogany**.

In the Atlántida, the decrease in availability of mahogany forced several businesses out of the market; however this decrease was not quite as drastic as in other regions, especially Quintana Roo. This was mainly because of the existence of sufficient volumes of other species that were direct or technical substitutes for **mahogany**.⁶ The companies did not have any problems with changing their production to the new species, because most of the furniture is painted before being sold, so that the grain and color of the wood do not have the same importance. However, the companies in the Atlántida are exposed to growing competition in their traditional markets (see Chapter 5.1.2 and 5.3.2; see also Box 16 and 34).

An important neglected aspect of the timber sector in the Atlántida is the trade in motorsawn lumber by *madereros*. The *madereros* are the principal suppliers to secondary industries in San Pedro Sula and La Ceiba. The *madereros* are for the most part small businessmen. The smallest business does not deal with more than 10,000 board feet annually, while the more active ones probably exceed 300,000 board feet. The *madereros* who exceed 100,000 board feet a year are few and far between numbering fewer than

twenty. Their strengths lie in various areas. Not only do they know the producers and consumers of timber well, but they also know how to transport their products, legal or not, to the centers where the wood is sold. Paradoxically, *madereros*, who have always been seen as a source of chaos in the forestry sector, have allowed companies who buy hardwoods to continue to function even when government bodies have practically put a halt to the production of legal timber. Presently, facing the threat of a ban on extracting precious woods, it is the *madereros* who allow businessmen involved in secondary processing to sleep relatively well at night.

In discussions about the forestry sector, the *madereros* are always perceived as the “bad guys” and are blamed for many of the existing forest exploitation problems. This came about not only because many of them work with illegal timber, but also because of having to be a middle man for agricultural or forest products, which means you are assumed responsible in some way for exploiting producers. Nobody is willing as of yet to recognize that trade and established distribution channels are essential parts of the production chain and that *madereros* play an important role.

San Pedro Sula is the seat of diverse institutions of higher education and research, amongst which is the Centro de Utilización y Promoción de Productos Forestales (CUPROFOR, see also Chapter 8.1.1).

1.2.3 The state of Quintana Roo - Mexico

The state of Quintana Roo is located in the southeast of Mexico. It has a surface area of 5,084,300 hectares. The forests important for commercial log supply are located principally in the center and south.

Quintana Roo has been an important center for immigration since the beginning of the twentieth century. Three migratory influxes can be differentiated:

⁶ See glossary for the definition of direct and technical substitutes.

- At the beginning of the century, various groups of *chicleros* (chicle tappers) settled in the south of the state. Chicle is the latex of chicozapote [*Manilkara zapota*], the raw material for natural chewing gum). These groups later obtained the legal right to use the land in the form of ejidos.
- Migrating from the neighboring state of Yucatan, a great number of Mayas settled in the central region of the state, becoming neighbors of Mayas who already lived in the region.
- In the seventies, peasants from other Mexican regions with cattle-ranching, sugar-cane, and general agricultural traditions settled in the southern part of the state. These peasants also became ejidatarios.

Since the 1980s, immigration to rural areas has steadily decreased and been replaced by emigration to the principal tourist center of the state,

Cancun. Along with these trends, agricultural, livestock, and forestry production have lost importance compared to the services sector, which currently contributes more than 70% of Quintana Roo's gross domestic product.

The main cities of this state are Cancun (400,000 inhab.), Chetumal (120,000 inhab.) and Felipe Carrillo Puerto (40,000 inhab.). Cancun is an important market for finished wood products, but unlike the situation in the Atlántida, supply relationships with forestry and wood products producers of the state are weak. From the south of Quintana Roo, Cancun buys posts and grass for the roofs of buildings used for tourism purposes, but furniture comes from elsewhere. Chetumal and Felipe Carrillo Puerto are small end-markets for forest products.

The region has good road infrastructure. Approximately 70% of the rural settlements have access to a highway. Towns normally have elec-

BOX 5

Reinventing community forestry in Quintana Roo

Community forestry in the peninsula of Yucatan has its roots in Prehispanic Mayan culture. In the 1940s, the Mexican government successfully added a state structure to these traditions by creating chicle extracting ejidos. Timber extractions remained in private hands. As a consequence of new immigration in the seventies, increasingly larger areas of forest were converted to other land uses, leading to a crisis in the model of private forestry concessions.

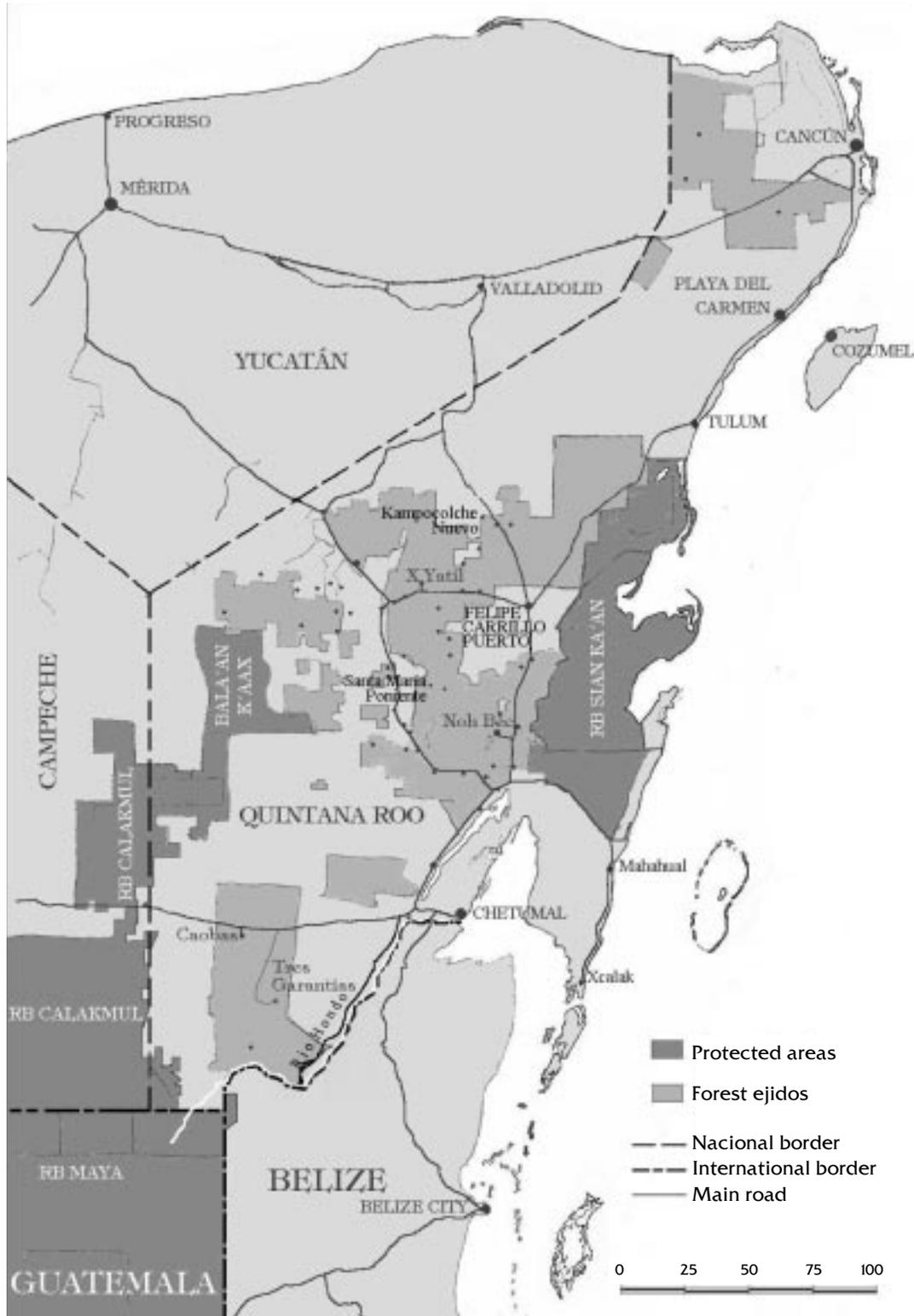
At the beginning of the eighties, top bureaucrats of the state government and the federal ministry responsible agreed on the need for change. An important group of ejidos was pushing for the right to exploit timber resources. Moreover, a technical team was already established, capable of directing the technical, organizational and political processes needed. At the same time, the

opposing coalition, made up of traditional timber merchants and middle management in the governmental institutions, had lost power and could not slow down the process.

Unlike Honduras, where community forestry was set up under a national law, community timber extractions in Quintana Roo started in a limited geographical area, but allowed greater conceptual freedom for the technical teams. Within this setting, it was possible to question and experiment with many key elements of community forestry: The role of technical assistance groups, regulatory role of the state, the rights, obligations, possibilities and restrictions of communities and, in general, the level of equilibrium which has to exist in order for community forestry to work. The model was gradually expanded and consolidated institutionally.

BOX 6

Quintana Roo, Mexico



tricity, clean water, primary schools, and a small medical center. The entire state has access to ports, all within 5-7 hours trip by truck from the production centers.

The industrial infrastructure in the south of Quintana Roo has gone through some dramatic transformations over the last twenty years. At the end of the seventies, there were 15 forestry enterprises that combined extraction and primary processing (sawing or plywood), and in some cases, secondary processing. Fifteen small and medium secondary processing enterprises also existed. Currently 90% of the wood products businesses that used to exist have closed down or changed hands. Most of the sawmills were sold to the communities. Of the four businesses that produced panels and plywood, the largest has closed down, while the others are working at a slower pace. Many secondary processing enterprises have closed. However, two flooring companies have opened with significant financial capacity, strong market orientation, and high-level managerial skills (see also chapter 8.1.3, PIQRO company).

1.2.4 Región Autónoma del Atlántico Norte (RAAN) - Nicaragua

The RAAN occupies a quarter of the total Nicaraguan territory (3.2 million hectares) and is located in the northeast of the country. It has always been isolated from the central Nicaraguan power-base and is sparsely populated (average six inhabitants/km²; less than 5% of the country's population). For this reason, it is currently seen as a formidable land reserve, exposed to strong migration pressure from other regions.

The RAAN lacks high ground. Most broadleaved, exploitable forests are found in the Atlantic plains, bounded by large swamps or by sandy savannahs where the Caribbean Pine (*Pinus caribaea*) is dominant. Towards the west, the terrain slowly increases to altitudes of 300 to 600 meters. It is here where conversion to pasture lands is more advanced.

About 82% of the region is forested. Unlike the other study regions (the south of Quintana Roo, the Petén, and the Atlántida), where migra-

tory pressure is decreasing, the RAAN continues to have all the characteristics of a frontier region:

- Migratory pressure and high conversion rates of woodlands.
- Physical infrastructure (i.e. roads, electricity supplies, clean water, drainage systems, and schools) and public services (i.e. security, education, health, and legal system) are still very weak.
- There is a limited institutional capacity to regulate and control land use and high levels of violence and crime (related to drug trafficking and property rights).
- Three quarters of the population work in the primary sector: Fishing, subsistence agriculture, and forestry activities. The *colonos* from the Pacific area and center of the country have a livestock background.

The principal city of the region is Puerto Cabezas (Bilwi), which has around 30,000 inhabitants. Regional infrastructure is poorly developed. The highway to Managua is a rough dirt track in very poor condition. There is the possibility of transporting timber by sea or river.

Two large forest product enterprises exist in the region which combine extraction, primary processing (sawing and plywood) and, in one case, secondary processing. Otherwise, the industrial infrastructure is restricted to portable sawmills that often operate on the fringes of the law.

The history of the autonomous region of the North Atlantic is to a large extent the history of the Miskitos people, who have lived here for hundreds of years and the dominant indigenous group in the region (but not the only one). The English, who settled in the Atlantic Region in the eighteenth century and exploited precious woods to supplement their shipping needs, negotiated directly with the Miskitos and did not intervene in the extraction process. All other external groups who arrived after the English have had to negotiate their stay with the Miskitos, as have most recently the Sandinistas. The Spanish, who had their power base on the Pacific coast and the mountains, never developed significant activities in the Atlantic region.

BOX 7

First steps towards community forestry: the RAAN

Nicaragua is the one country in the study where the situation regarding community forestry is least clear. Various indigenous groups (e.g. miskitos and mayagnas) have lived in the region for hundreds of years as fishermen, subsistence farmers and, through timber extractions, managing resources in the community. There is a law based on this fact, to give indigenous groups ownership of “lands, waters and forests” which have traditionally belonged to them (Article 28 of the Statutes of Autonomy of Nicaragua’s Atlantic coast).

Beyond these two factors described above, that appear to support establishment of community forestry, practically all is uncertain: The indigenous groups do not have access to the legal tools to determine their customary rights; national forestry policies are contradictory and do not take into consideration the situation of indigenous groups; governmental attributions are distributed over a large number of bodies (e.g. municipal and regional governments, and various ministries); and corruption is clearly present amongst the government officials at various levels diverse entities, which is taken advantage of by migrants from other regions to obtain deeds to lands which the indigenous communities believe are theirs.

The indigenous groups have traditionally been governed by a council made up of the oldest members of the group, who represent the group and make internal decisions, as well as having certain legal functions. With the advent of the state, its political structure (municipios - mayoralties) is replacing communal structures to the degree that the municipal trustee (a position in the mayor’s office) is now the principal authority in the community. Normally the trustee is elected by the community itself, but currently mayors (elected for the whole municipality) are increasingly choosing trustees who are close to them. Therefore a division along party lines is being accentuated in the communities, and the community itself is losing its capacity for self-determination. It is important to remember that Law 28 of Autonomy recognizes communal property, but does not define what constitutes a community, nor does it define community decision making procedures. The decision-making and representative powers that communities previously held are now being passed over to the mayor’s office. For the decisions concerning land use, this process is negative; passing decision-making to the mayor’s office weakens the communities’ interest in communal use of resources, and the mayor’s office does not have the operational skills to direct forest management.

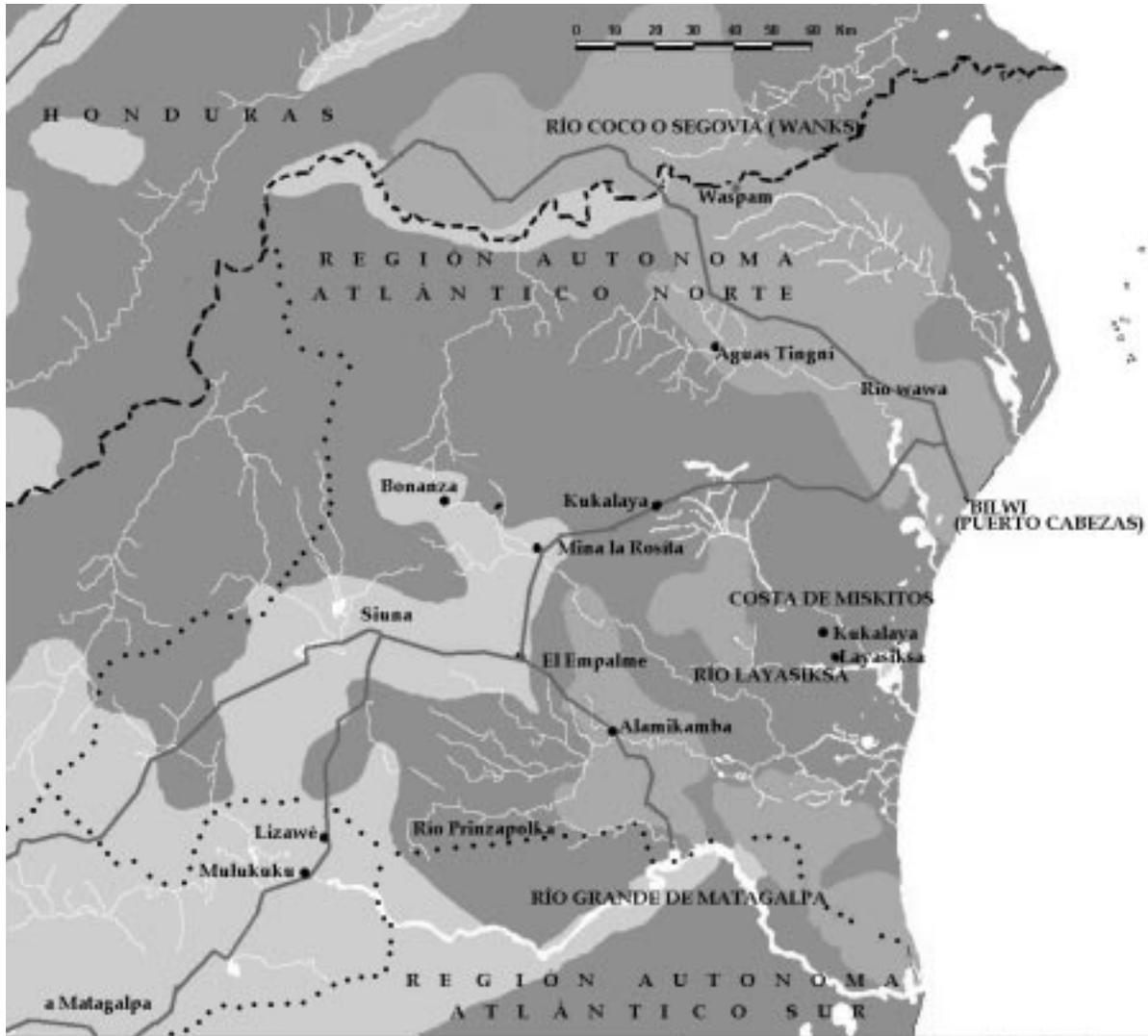
Towards the end of the nineteenth century, businesses from the U.S. began to exploit the forests, extracting **mahogany, cedro real, roble, pochote (cedro espino), guayacán, mora quebracho, brasil, ñambar and palo de rosa**. Enterprises with the capacity to process 55,000 board feet of timber daily, often working with almost 600 employees, were developed. No forest management existed, but the concentration on mahogany trees of large diameters probably reduced long-term effects on forestry ecosystems.

At the end of the nineteenth century, the colonization of the Atlantic Region began from the northern central region.

This process led to the establishment of coffee plantations and opening of road links between the Atlantic and Pacific coasts. With the development of international markets and demand for certain products, cattle ranches were established all along the strip in the central region and north of the country (Matagalpa, Boaco, Chontales), directly affecting the forest ecosystems in these departments.

BOX 8

Autonomous Region of the North Atlantic (ANAR), Nicaragua



- Broadleaved forests
- Pine savanna
- Non forest cover
- State border
- Main road
- International border

Source: Based on International Travel Maps, Canada, and World Conservation Monitoring Centre (1996)



A second large-scale colonization process began in the sixties, with policies that provided incentives for intensive stockbreeding. Thus began a migratory trend, which still continues to penetrate the rainforests, spreading into lands increasingly unsuitable for cattle and agriculture, and converting extensive woodland areas into pasture. Unlike other study regions, which at the beginning of the twentieth century were virtually deserted, or whose existing populations were not directly affected by colonization, the colonization of the RAAN often took place on land belonging to indigenous groups. The migrants have advanced along the roads from west to east, settling first on the highest grounds (150 to 600 metres above sea level) and gradually converting towns which were indigenous into frontier towns, with a predominantly mestizo population.

1.3 Methodology

Four methods were used to gather information and data for this study:

- Analysis of community operations: Various community forest operations were visited

in the study regions, and community leaders, forestry workers, but also people not active in the operations were interviewed. The analysis was carried out with instruments from the Rapid Rural Appraisal. To complete the picture, interviews were also carried out with forest technicians, extension agents and buyers.

- Description of the production chains including markets: Companies in the processing chain were visited to try and capture the types of companies that exist on a regional level and the principal buyers on a national level.
- Analysis of marketing experiences: Interviews were carried out with people who have promoted the use of lesser-known species or changes in processing that facilitated the marketing of lesser-known species, to characterize the more promising initiatives.
- Study of literature and empirical knowledge on characteristics of lesser-known species: Existing literature on the characteristics of lesser-known species was studied and information gathered from timber processors. Various studies on utilization rates were also evaluated.

2 FOREST RESOURCES

2.1 Forested areas

The countries studied have about 36 million hectares of broadleaved forests among them, out of which a little less than 33 million hectares are in regions where community forestry is dominant. The study regions include a significant area of forests with communal management (see box 9).

Altogether, there are 1, 200, 000 hectares with extraction permits in the four regions studied, of which 90% can be considered under some sort of community forestry scheme. In Quintana Roo, all of the area indicated, more than half a million hectares, is under the control of community operations. In the Atlántida, the situation is practically the same. In the Petén, there are two private

BOX 9

Forest areas in Mesoamerica [hectares]

Country	Total area of broadleaved forests	Area of regions with community forestry*	Study Region	Area of broadleaved forests	Areas with extraction permits
Guatemala	3,017,600	1,700,000	→ RBM	1,700,000	318,408
Honduras	2,705,600	2,280,200	→ Atlántida	527,600	110,000
México	26,440,000	26,440,000	→ Quintana Roo	3,686,700	533,601
Nicaragua	3,800,000	2,280,000	→ RAAN	1,600,000	240,000
Total	35,963,200	32,700,200	Total	7,514,300	1,202,009

** This refers to forested areas in regions where community forestry is dominant; it includes certain areas not controlled by communities. The data presented here are based on the information which was available, whose quality varies considerably.*

Source: diverse data.

company concessions with some 45,000 hectares each. In the RAAN, most areas where extraction is carried-out are communal land.

The reason for the difference between total forested area and forested areas with extraction permits is the existence of areas with total protection (e.g. reserves and forests on very steep slopes), areas with secondary forests, which are not yet of commercial size, and areas which because of their distance or legal reasons are not commercially available. The last category implies that the amount of forested land subject to commercial harvest operations could increase in the mid term:

- In the RBM, 40,000 to 80,000 hectares more could be managed.
- In the Atlántida, more than 150,000 hectares could be added, totaling at least 250,000 hectares.
- In Quintana Roo, expansion of forested areas subject to commercial harvest over the next few years basically depends on solving the problem of how to manage the vast areas covered predominantly with smaller diameter trees

(see Box 35). Over the next ten years, an additional 100,000 hectares could be added if a solution is found to this problem.

- In the RAAN, there is forestland that is officially available for some type of commercial forest operations, but there is not a well-organized forestry service to manage additional forest operations. Here, the forestry service, and in general, the system of forest use, still has to be consolidated. Despite this, it is realistic to estimate that the area that could be officially accessed for commercial purposes could increase by 70,000 hectares over the next few years.

In total, the forested surface area available for commercial extraction could increase by approximately 400,000 hectares in the coming years.

2.2 Potential annual harvest⁷

As a consequence of significant differences in rainfall (from 1300 to 4000 mm per year) and other

BOX 10

Potential annual harvest of hardwoods and extrapolated annual potential*

Region	Area under inventory [ha]	Annual authorized volume [m ³]	Authorized volume ha [m ³ /ha]	Estimated area [ha]	Annual extrapolated potential [m ³]
RBM	258,268	48,039	0.186	318,408	59,225
Atlántida	89,739	104,707	1.167	110,000	128,347
Quintana Roo	533,601	153,627	0.284	533,601	151,529
RAAN	nd	nd	1.200	240,000	288,000

* The information is based on the extraction permits issued by the respective institutions. It includes permits for **mahogany** and cedro (see also the following tables). The extrapolated potential refers to the volume which could be exploited if all exploitable areas were counted instead of only counting those which have applied for an extraction permit.

Source: own work from diverse data.

⁷ This volume refers to the volumes authorized for harvest by each regional forest service, normally based upon inventories and management plans.

variables (soils, slopes), the forests of the four study regions are diverse, resulting in canopy heights ranging from a little more than 15 m in Quintana Roo up to more than 40 m in parts of the Atlántida and the RAAN. In these two regions trunk diameters of more than a meter are common, whereas in Quintana Roo average log sizes are smaller (i.e., with diameters as small as 25 cm small-end).

How harvest operations are silviculturally regulated (i.e. minimum diameters for felling, cycles and intensity of felling) also differs between regions. The Petén has probably the most conservative guidelines. All of these elements affect the annual legally available volume in the regions.

The results presented in Box 10 are based on the data available in the study regions

The overall currently available potential of the four regions is around 630,000 m³ annually. This includes approximately 30,000 m³ of **mahogany** per annum. This potential is small if compared to international production standards. A fairly large consortium in Brazil can easily reach production levels of 150,000 m³, using maybe 20 species, not the fifty or so needed to obtain this volume in Central America.

Another characteristic that creates a disadvantage for regional log production is log form. Their diameters in Mexico are very small. Although larger diameter trees are available in the forest, the Atlántida does not produce any logs, just rough-sawn or hand hewn timber with smaller dimensions. Currently, only Nicaragua produces logs that can compete in terms of quality and diameters with Brazil, Bolivia or Peru.

Although the afore mentioned volumes are small by international production standards, they are important assets by regional standards. Here is an important potential for local companies to profit on.

2.2.1 Potential annual harvest in the RBM (Petén)

Box 11 shows the potential harvest for the most important species in eleven concessions in the RBM, accounting for approximately 90% of all volumes.

Light and Medium-Weight Species. **Mahogany** (*Swietenia macrophylla*) is still the most important commercial species in this group. A significant volume of **cedro** (*Cedrela odorata*) has also been reported. In some regions, the values shown for these species will probably have to be corrected in the coming years due to overexploitation.

The only direct substitute for **mahogany** that exists in any volume is **Santa María** (*Calophyllum brasiliense*).

Light-coloured woods show significant potential. **Jobo** (*Spondias mombin*), **chacaj Colorado** (*Bursera simaruba*), and **mano de león** (*Dendropanax arboreus*) are species that could be used interchangeably for the production of furniture or mouldings because they all look alike. These species could eventually be marketed under one commercial name (in México **jobo** and **chacah** have been marketed together under the name **jocha**).

Amapola (*Pseudobombax ellipticum*) has been used as a **mahogany** substitute. It is difficult to distinguish stained **amapola** from **mahogany**. However, because of its greyish colour and light weight, it will have to be commercialized as a separate species. **Amate** (*Ficus* sp.) is another important species in terms of present volumes that because of its very particular characteristics will have to be commercialized separately as well (see also appendix 2).

Regarding medium-weight species, the volume of **santa maría**, **danto** (*Vatairea lundellii*) and **sunza** (*Licania platypus*) is promising. Significant volumes of other medium-weight species –**tzalam** (*Lysiloma bahamensis*), **canxan** (*Terminalia amazonia*), **cola de coche** (*Pithecellobium arboreum*), **guaciban** (*Pithecellobium leucocalyx*)—do not exist, but their marketing should not be too difficult because they reach significant volumes in other countries and are well known.

Heavy species: Results of this study indicate that **pucté** (*Bucida buceras*) dominates in terms of volume. Previously, this species was considered of little significance in terms of volume, far below **ramón** and **chicozapote**. For example, the

BOX 11

Potential annual harvest in the RBM

Species	SG	Potential harvest [m ³]	
Light and medium species			
Mahogany	Swietenia macrophylla	0.45	4,875
Santa María	Calophyllum brasiliense	0.52	2,892
Amapola	Pseudobombax ellipticum	0.35	2,162
Jobo	Spondias mombin	0.39	1,881
Danto	Vatairea lundellii	0.62	1,219
Chacaj Colorado	Bursera simaruba	0.38	899
Mano de león	Dendropanax arboreus	0.40	878
Sunza	Licania platypus	0.58	778
Cedro	Cedrela odorata	0.40	703
Ceiba	Ceiba pentandra	0.36	550
Amate	Ficus involuta	0.48	497
Tempisque	Masticodendron capari	nd	494
Jesmo	Lysiloma sp.	nd	486
Yaxnik	Vitex gaumeri	0.53	435
Tzalam	Lysiloma bahamensis	0.63	366
Guasiban	Pithecellobium leucocalyx	0.52	312
Saltemuche	Sickingia salvadorensis	0.60	245
Pasaque Hembra	Simarouba glauca	0.35	243
Matasano	Casimiroa edulis	nd	231
Luin Macho	Drypetes brownii	nd	181
Canxan	Terminalia amazonia	0.52	109
Copo	Coussapoa oligocephala	s.d	82
Son	Alseis yucatanensis	0.64	68
Cola de Coche	Pithecellobium arboreum	0.56	42
Heavy species			
Pucté	Bucida buceras	0.85	7,292
Ramón Blanco	Brosimum alicastrum	0.73	4,224
Ramón Oreja de Mico	Brosimum costaricanum	0.73	3,379
Chicozapote	Manilkara zapota syn achras	0.85	2,878
Silion	Pouteria amygdalina	0.78	1,260
Catalox	Swartzia lundellii	0.79	942
Malerio Blanco	Aspidosperma stegomeres	0.78	860
Manchiche	Lonchocarpus castilloi	0.79	841
Jobillo	Astronium graveolens	0.75	793
Malerio Colorado	Aspidosperma megalocarpon	0.78	689
Luin hembra	Ampelocera hottlei	0.66	665
Sacuché	Rehdera penninervia	0.75	539
Chechen Negro	Metopium brownei	0.70	493
Canisté	Pouteria campechiana	0.78	488
Ramón Colorado	Brosimum sp.	0.73	380
Zapotillo hoja fina	Pouteria mayeri	0.85	291
Chichipate	Sweetia panamensis	0.79	86
Manax	Pseudolmedia oxyphyllaria	nd	81
Hormigo	Platymiscium dimorphandum	0.69	60
Other species recorded			167
TOTALS			48,039

Source: Inventories of: Chosquitán, Río Chanchich, Las Ventanas, Uaxactún, San Miguel, La Pasadita and Cruce Dos Aguadas, Arroyo Colorado, San Andrés, Paxbán, Carmelita, Bethel, Técnica Agropecuaria and Unión Maya Itzá (UMI). Total Area of Inventory: 258,268 ha.

inventory carried out by the German-Guatemalan agreement (1992), which covered approximately 2.5 million hectares, placed **pucté** in eleventh place in regards to harvestable volume. The top places were occupied by **ramón blanco** (*Brosimum alicastrum*), which represents nearly 10% of the total volume, **chicozapote** (*Manilkara zapota*) with 6%, **guapaque** (*Dialium guianense*) with 5% and **yaxnik** (*Vitex gaumeri*), with 3%.

In the case of **chicozapote**, the difference between the cited inventory and the results presented in Box 11 can be explained by the fact that there is a ban on logging this species, so it is not considered in many inventories, such as the inventory of San Andrés and Paxbán, and the inventories of the Eastern region. In the latter cases, previous inventories of the same zones (Gálvez, 1992), showed volumes of over 10 m³/ha of **chicozapote**.

Guapaque (*Dialium guianense*) may not have been included in the inventories because it is considered noncommercial due to high silica content. The exclusion from inventory data is probably the case for other species with small volumes or which are considered noncommercial for some reason. To reduce costs, many inventories only gathered data about certain species selected for their commercial significance. This implies a tendency to undervalue non-commercial species. For these reasons, it is likely **ramón** was not considered in some inventories.

Because of their characteristics, the heavy species have to be marketed separately. An exception could be ramón species [*Brosimum alicastrum* and *B. costaricanum*]. Realistically, the numbers cited for the various *Brosimum* spp. need to be questioned since the inventory teams cannot always reliably differentiate them.

Many of the species in this group have what are considered negative characteristics, which up until now has slowed their introduction to markets. Some negative characteristics can be counteracted relatively simply and economically. Others, like the high content of silica in *Pouteria* spp., are unacceptable for many uses.

2.2.2 Potential annual harvest in the Atlántida

The available information (Box 12) refers to 37 inventories which covered a total of 19,980 hectares. A total of 55 permits have been issued covering an area of 89,739 ha with a potential extractable volume of 104,707m³.

The following conclusions can be made based on the data presented in Box 12:

- The importance of **mahogany** (*Swietenia macrophylla*) has greatly declined. Only two operations show significant volumes in their inventories. Therefore, it is not possible to extrapolate quantities of this species for the area as a whole that is currently authorized for harvest.
- Fortunately, a great number of species exist that can substitute for **mahogany**, either directly (e.g. same colour and similar grain) or as technical substitutes (e.g. similar technological characteristics). The wood most often used as a **mahogany** substitute is **San Juan areno** (*Ilex skutchii*) because it is easy to work, has fine texture, attractive grain, and an off-white colour, which is amenable to practically any kind of stain.
- The inventories show limited quantities of heavy woods. As in Guatemala, this could be because inventories did not record species not considered commercial. **Selillón** (*Pouteria izabalensis*) can be used as an example. This is a species that does not appear in the inventories, but was one of the best-selling species during the time a company that produced truck beds was in operation. Another species that might have volumes greater than those recorded in the inventories is **paleto** (*Dialium guianense*). This species is considered to be very difficult to process (high silica content). Therefore many inventories do not list it, although farmers mention this species very often when asked to name the most common species in their forests.

BOX 12

Potential annual harvest in the Atlántida (37 forest operations)

Species	SG	Potential harvest [m ³ /year]	
Light and medium species			
Cumbillo	Terminalia amazonia	0.64	6,467
San Juan Rojo	Vochysia jafensis	0.44	4,520
Varillo	Symphonia globulifera	0.56	3,148
Huesito	Macrohasseltia macroterantha	0.62	2,507
Cedrillo	Huerteia cubensis	0.37	2,391
Piojo	Tapirira guianensis	0.42	2,467
Rosita	Hieronyma alchorneoides	0.61	2,226
Redondo	Magnolia yoroconte	0.52	2,029
Sangre Real	Virola koschnyi	0.36	1,916
San Juan Areno	Ilex tectonica	0.46	1,774
María	Calophyllum brasiliense	0.53	1,374
Marapolan	Guarea grandifolia	0.56	1,255
Pepenance	Byrsonima spicata	0.44	1,118
Mahogany	Swietenia macrophylla	0.45	1,056
Cedro Real	Cedrela odorata	0.33	1,003
Jigua	Nectandra hihua	nd	612
San Juan Peludo	Vochysia guatemalensis	0.41	588
Barba de Jolote	Cojoba arborea	0.61	449
San Juan Guayapeño	Tabebuia donnell-smithii	0.45	282
Aguacatillo	Ocotea caniculata	nd	275
Coloradito	Gordonia brandegeei	0.64	231
Teta	Zanthoxylum belizense	0.43	219
San Juan Colorado	Vochysia ferruginea	0.38	219
Laurel Negro	Cordia megalantha	0.44	154
Cedro Peludo		nd	146
Cuajada	Dendropanax arboreus	0.40	142
Negrilo	Simarouba amara	0.35	84
Cipres	Podocarpus guatemalensis	nd	76
Sangre Blanco	Pterocarpus hayesii	0.45	72
Indio Desnudo	Bursera simaruba	0.33	44
Carbón	Guarea glabra ?	0.52	44
Granadillo	Dalbergia tucurensis	0.53	34
Macuelizo	Tabebuia rosea	0.57	23
Laurel	Cordia alliodora	0.44	19
Nogal	Juglans olanchana	0.40	8
Heavy species			
Jagua	Genipa americana	0.66	255
Cortés	Tabebuia guayacan	0.85	42
Guapinol	Hymenaea courbaril	0.78	5
Other species recorded			52
TOTAL			39,378

Source: inventories of 37 localities carried out by AFE-COHDEFOR (different years).

2.2.3 Potential annual harvest in Quintana Roo

Once again it is important to mention a possible bias in the information presented. Because **chicozapote** (*Manilkara zapota*) is not currently used for timber products, it has probably not been fully considered in the inventories. Therefore, the quantities shown are probably far lower than actual volume. The same could have occurred with

ramón (*Brosimum alicastrum*), which in Quintana Roo people prefer not to fell given its importance for animal fodder, and, during difficult periods, for human consumption.

It is interesting to note that the species which have seen the most increase in use over the last few years are exactly those species which are most common in the rainforests: **Tzalam** (*Lysiloma bahamensis*), **chechén** (*Metopium brownei*) and **sacchacah** (*Dendropanax arboreus*). The ex-

BOX 13			
Potential annual harvest in Quintana Roo			
Common name	Scientific name	SG	Annual potential [m ³]
Light and medium species			
Tzalam	<i>Lysiloma bahamensis</i>	0.63	15,697
Yaaxnik	<i>Vitex gaumeri</i>	0.52	13,576
Mahogany	<i>Swietenia macrophylla</i>	0.45	11,049
Chacah rojo	<i>Bursera simaruba</i>	0.38	9,891
Amapola	<i>Pseudobombax ellypticum</i>	0.35	4,853
Sacchacah	<i>Dendropanax arboreus</i>	0.40	3,395
Higo	<i>Ficus</i> spp.	0.48	3,044
Negrilo	<i>Simarouba glauca</i>	0.35	1,397
Jobo	<i>Spondias mombin</i>	0.39	417
Ceiba	<i>Ceiba pentandra</i>	0.36	23
	Other light and medium and unspecified species*		14,414
Heavy species			
Chechen	<i>Metopium brownei</i>	0.70	13,835
Zapote	<i>Manilkara zapota</i>	0.85	9,618
Katalox	<i>Swartzia cubensis</i>	0.79	6,633
Ramón	<i>Brosimum alicastrum</i>	0.73	6,471
Jabín	<i>Piscidia cummunis</i>		5,870
Chakteviga	<i>Caesalpinia platyloba</i>		1,626
Pucté	<i>Bucida buceras</i>	0.85	1,601
Chacte Kok	<i>Sickingia salvadorensis</i>	0.60	1,562
Machiche	<i>Lonchocarpus castilloi</i>	0.79	447
Palo de tinte	<i>Haematoxylon campechianum</i>		152
	Other heavy and unspecified species		11,890
"Palizada"***	Various species		16,167
TOTAL			153,627
*) Some permits are not given specifying the species, but rather by group of species: "precious", "soft" and "hard". This means that annual volume per species is sometimes greater than that indicated, whilst volume subsumed under "others and unspecified" are lower than the value registered.			
**) Posts with diameters of less than approximately 20 cm DBH.			
Source: data from Semarnap, 2000			

ception is **ya'axnik** (*Vitex gaumeri*), which despite large volumes, has not managed to penetrate markets due to the bad shape of its logs.

2.2.4 Potential annual harvest in the RAAN

As of yet, there is no consolidated information on the volume of timber in Nicaragua or in the RAAN. Inventories have been conducted in all the tropical rainforest areas, but methodologies and circumstances differ enough that comparisons are difficult. The information shown in Box 14 is an adjusted average of the most reliable inventories conducted so far in the RAAN. Even if the accuracy of the volume shown here cannot be assumed, estimates can be made about relative species' abundance:

- Very abundant species (more than 3 m³/ha of standing timber over minimum cutting diameter; species are found in all operations): **Cedro macho** (*Carapa guianensis*), **comenegro** (*Dialium guianense*), **zopilote** (*Laetia procera*) and **nancitón** (*Hieronyma alchorneoides*).
- Abundant species (between 1 and 3 m³/ha of standing timber over minimum cutting diameter; species found in most operations): **Leche maría** (*Symphonia globulifera*), **sebo** (*Virola koschnyi*), **santa maría** (*Calophyllum brasiliense*), **jobo** (*Spondias mombin*), **ojoche** (*Brosimum alicastrum*), **palo de agua** (*Vochysia hondurensis*) and probably **mahogany**. **Mahogany** is found in the "forestry extraction frontier"; remote areas where companies high grade the most valu-

BOX 14			
Weighted average of exploitable volume in the RAAN			
Species		P. E.	m ³ /ha
Light and medium species			
Cedro Macho	<i>Carapa guianensis</i>	0.47	6.70
Nancitón	<i>Hieronyma alchorneoides</i>	0.61	3.50
Santa María	<i>Calophyllum brasiliense</i>	0.52	2.25
Leche María	<i>Symphonia globulifera</i>	0.56	1.75
Sebo	<i>Virola koschnyi</i>	0.36	1.70
Jobo	<i>Spondias mombin</i>	0.39	1.20
Palo de Agua	<i>Vochysia hondurensis</i>	0.34	1.05
Mahogany	<i>Swietenia macrophylla</i>	0.45	1.02
Coyote	<i>Platymiscium sp.</i>	0.58	0.65
Quebracho	<i>Pithecellobium arboreum</i>	0.65	0.41
Cedro Real	<i>Cedrela odorata</i>	0.33	0.22
Heavy species			
Comenegro	<i>Dialium guianense</i>	0.85	5.00
Guayabon	<i>Terminalia amazonia</i>	0.66	1.55
Ojoche	<i>Brosimum alicastrum</i>	0.73	1.50
Mora	<i>Clorophora tinctoria</i>	0.88	1.00
Guapinol	<i>Hymenaea courbaril</i>	0.78	0.90
Kerosen	<i>Tetragastris panamensis</i>	0.70	0.85
Quita Calzón	<i>Astronium graveolens</i>	0.75	0.55
Almendro	<i>Dipteryx panamensis</i>	0.85	
Zopilote	<i>Laetia procera</i>	0.68	4.75
TOTAL			36.55
Source: General Management Plans (PGM) and Forestry Inventories from: Awas Tigni, Sansagwas, Kukalaya and Wacambay in the RAAN (made between 1995 and 1997).			

able species (the phenomenon of “nomadic” timber extraction has ceased in other regions). Due to the nature of this kind of exploitation, high-quality inventories do not exist.

- Less abundant species (between 0.5 and 1 m³/ha of standing timber over minimum cutting diameter; species are abundant in some operations): **mora** (*Clorophora tinctoria*), **guapinol** (*Hymenaea courbaril*), **kerosén** (*Tetragastris panamensis*), **coyote** (*Platimiscium* sp.), **cortez** (*Tabebuia guayacana*), **quita calzón** (*Astronium graveolens*), **quebracho** (*Pithecellobium arboreum*), and **cedro** (*Cedrela odorata*).

Total standing volume greater than minimum cutting diameter volume per hectare shown in Box 14 (36 m³/ha) closely corresponds with other estimates:

- The Forestry Action Plan of Nicaragua calculated a volume of 30 m³/ha for all species in the categories above minimum cutting diameter (usually 55 cm).
- According to IRENA/SWEDFOREST (1985), in the RAA and the RAAS a volume of 200 m³/ha of timber existed and 30 m³/ha were in categories above minimum cutting diameter

(considering 30 species). For Río San Juan, a volume of 260 m³/ha and about 35 m³/ha above minimum cutting diameter was assumed.

- For the RAAS, in the northern zone of the River Kung Kung, an inventory was conducted that included 53 species, with a total volume of 21.17 m³/ha and 11.82 trees/ha. The weighted average for the 15 species considered commercial was 18.43 m³/ha, with approximately 9.81 trees/ha.

Based on these studies and data derived from them, it can probably be safely assumed that the broadleaved forests in this region have the ability to yield at least 30 m³/ha above minimum cutting diameter. Combining the assumption of 30 m³/ha with a conservative estimate of 500,000 ha of broadleaved forests in the RAA and a harvest cycle of forty years, yields an annual potential volume of 375,000 m³, of which a third would be highly commercial species (**mahogany**, **cedro** and **cedro macho**). However, this assumes a minimally organized forestry system able to comply with silvicultural guidelines and regulations (e.g. felling cycles and minimum diameters for felling), and reliable data about volumes extracted, which currently do not exist.

3 FOREST USE

3.1 The rise of community forestry

Thirty years ago, the granting of forestry concessions to private companies was the dominant commercial forestry model in Mexico and Central America. The criteria for granting concessions, the obligations that concessionaires acquired, and the way in which extractions were carried out varied considerably. Even though some of these enterprises carried out the first inventories and management plans in the region, most of them maximized timber extraction with no consideration for silvicultural aspects.

One benefit of this type of commercial forest use was the establishment of an important regional industrial base. Various sawmills and a few plywood companies were set up, and in regions with important regional markets, a secondary processing industry was established. In fact, the large regional enterprises that exist today came to light at this time (in the sixties and seventies).

In most cases, industry has aimed to integrate extraction and primary processing. The products, usually sawn lumber and **mahogany** plywood, were sold to both domestic and foreign markets, but no new production links were created in the regions (“enclave production”). The companies basically competed through privileged access to standing trees and cheap labour.

In the sixties and seventies, the study regions were exposed to various changes that ultimately led to the end of the concessions, and weakened the position of the companies who worked with this model.

- During the seventies, massive colonization took place that, in the space of a few years, reduced the forested area where the concessions were located. In the light of the disappearing forest base, many companies decided to speed up extraction to stay “one step ahead” of the *colonos*, thus worsening the crisis.
- During the same period, world-wide criticism of private concessionaires’ poor performance grew. In some circles, it was argued that the wealth created from commercial tropical forestry operations had very limited impact on development, and cries for a type of “social forestry” were heard (Westoby, 1985). In various countries, alternatives to the concession model were sought, which eventually, and after many struggles by the communities themselves, led to the introduction of community forestry models. What seemed to be no more than a populist move to many, turned out to be an efficient tool to slow deforestation. At its best, this model delegated certain planning and controlling land use functions

to the local population, in an agreement which benefited both the local population (e.g. offering them a source of income) and regulatory bodies (e.g. improving their span of control in regions where land use could not be easily regulated). With appropriate forestry technical support, some communities achieved high enough levels of forest management to be certified by outside organizations, such as the Forest Stewardship Council (FSC), as practicing “good management”. For these reasons, community forestry did not disappear after a few years, but on the contrary, has grown.

The introduction of community forestry radically changed private company access to forest resources and caused serious timber supply problems for them. Previously, these companies were directly responsible for cruising and extraction, often paying no more than a token amount for the timber. Under the community forestry model, it became necessary to negotiate with communities, who feeling themselves in an advantageous position, often increased timber prices. Many communities began a process of vertical integration that allowed them to sell lumber, instead of just logs, outside the region, but reduced regional roundwood supply. Moreover, the forestry technicians who worked with the communities reduced the amount of **mahogany** produced because the species had been over-cut. At the same time, old prejudices and sensitivities made communication difficult. Traditional timber merchants (“*madereiros*”) and the communities saw each other as enemies, not allies in a common production chain. Finally, communities were often quite inflexible in terms of adapting to buyer requirements.

In summary, it can be argued that with the advent of community forestry, destruction of broad-leaved forests has been slowed substantially in agricultural frontier areas. It has also led to the introduction of important elements of good forest management. At the same time though, it has created an unstable relationship with private timber-processing businesses.

3.2 Regulation of forest use

At the beginning of the twentieth century the regions studied were sparsely populated by indigenous groups and groups dedicated to resource extraction activities.

- In Quintana Roo, Mayan rebels, fighting against the Mexicans, disease and hunger, had established a political-religious centre in the central portion of the current state.
- In the Petén, a small Mayan population and some resource extraction camps, which grew larger or smaller depending on world prices of the resources being extracted (chicle, timber), coexisted.
- The Atlántida was probably the most densely populated region. San Pedro Sula was already an important city that required cultivation of extensive land for food supply. The valleys had been cleared for export crops and small villages of agricultural workers had been established, while forests in the mountains remained intact and sparsely populated.
- Various indigenous groups lived in the current RAAN.

In all cases, the groups used the forested land extensively, through slash and burn systems or extraction of non-timber forest products. Most lands were considered public property and governments had established a system of timber concessions for private companies. Local populations were legally recognized owners of the land only in exceptional cases.

During the twentieth century, migration into the study regions grew. In general, the governments of these countries encouraged emigration, promising to give state land to poor peasants from other regions. Except for the first program of public land grants in Quintana Roo, which was aimed at chicle production, the system of government land grants in the regions studied directly or indirectly encouraged campesinos to clear forests, an activity that came naturally to them because most came from agricultural or cattle-raising backgrounds. This was the case in the south of

the Petén, the relatively flat parts of the Atlántida, and during the second emigration wave into Quintana Roo in the seventies. In the RAAN, this policy still continues.

Twentieth century colonization in Quintana Roo and the Petén, for the most part, did not cause problems with already established populations. In Quintana Roo, the colonos settled in the south, whilst the Mayan population concentrated in the central region of the state. Both groups received ejidal titles. In the Petén, the older villages were situated in the “forestry reserve” (currently the RBM), which is closed to new emigrants. Emigration in the RAAN, on the other hand, has created significant conflicts with the indigenous population.

Generally speaking, zones were colonized in a manner that left only small patches of woodlands, which were generally divided up between small landowners. The largest forested areas remained in zones that governments did not distribute (the present day RBM in the north of the Petén and the mountainous areas of the Atlántida forest region) and in forests controlled by “traditional” populations.

In Mexico, the most important woodland areas remained within the ejidal properties authorized during the first period of land distribution in Quintana Roo. In Nicaragua, the largest woodlands are found in areas where indigenous communities have customary rights and colonos have not yet penetrated.

It appears that the colonization of rural Quintana Roo is a process that has reached its end. Here, people have begun to abandon the countryside to go to the cities. Colonization continues in the Petén and the Atlántida, but at a much slower pace than two decades ago. Only in the RAAN does colonization pressure remain high.

Forest use rights have not necessarily come with property deeds or usufruct rights. Rather, it was often anticipated that communities would dedicate themselves to agricultural and cattle ranching activities, leaving forest extraction to private industry. This strategy failed because private enterprises were unable to prevent colonos from settling within their concessions and the sub-

sequent forest conversion. Because of this, the right to extract logs was given to forest communities of Quintana Roo at the beginning of the eighties, and to communities of the RBM in the mid-nineties. In this last case, concessions were also granted to industry, but these concessions were located in areas that were unlikely to be invaded by colonos.

In the Atlántida, the right to extract logs was granted to community groups in the mid-seventies. With the “Ley para la modernización y desarrollo del sector agrícola” passed in 1992, this right was severely limited. However, the law was not very realistic, so in practice, the groups continued to operate as before. Recently, bureaucratic procedures to obtain a permit for extraction purposes have become extremely difficult, leading to an increase in clandestine extractions.

In the RAAN, a coherent legal system to regulate forest use does not yet exist. Even though the indigenous communities should be able to exploit the forest by right, in actual fact they play a secondary role, due to the bureaucratic procedures that have to be followed. It is the *madereros* that take centre stage.

Only in Quintana Roo and in some Guatemalan cooperatives outside the RBM do communities own the forested areas. In the RBM, communities have obtained long-term concessions. In the Atlántida, groups have exploitation permits for only a short time, whilst in the RAAN there is still no clear regulation of property or usufruct land rights.

3.3 Characterization of forest operations

A community forestry operation can be defined as a group formed in a community near or within a forested area to carry out joint activities of forest management and forest products marketing. Normally, many community members are excluded from the community operation, so community and the community operation are not identical in terms of members. Apart from a few exceptions, women have been excluded from forestry decisions. In many cases, the group of men who take part in forest operations is also selective. In Quintana Roo, only

official members of the ejido participate in forest operations. Farmers living in the communities without ejido rights (generally those that settled in the ejido long after its inception) are not a part of this group. In the Atlántida, only a small fraction of the community is normally interested in forestry work and are therefore willing to organize in a group. Here, many men also work on their own as independent *motosierristas*.

In the study regions, around 150 community operations exist which sell timber: More than 50 in Quintana Roo, more than 20 in the Petén, more than 55 in the Atlántida, and between 15 and 25 in Nicaragua.

The forestry operations in the regions studied differ in many aspects, which also determine their capacity to manage the forests, process and sell their forest products, and in general, fulfill the objectives which their members have implicitly or explicitly proposed for them (see also 6.2).

a) Atlántida: the “**sociedades colectivas**” or “**grupos cooperativos**”. These are legally constituted groups formed by campesinos belonging to communities nearest to the woods. These operations control more than 85% of the areas authorized for forest extractions.

The first groups were formed a little after the establishment of the *Sistema Social Forestal* in 1974, often joining the Cooperativa Regional Agroforestal, Colón, Atlántida, Honduras, Ltda. (COATLAHL) and selling through this organization; in other cases as independent organizations. Some groups went through a period of slow or no growth, and individuality (some *motosierristas* became self-employed). It was only at the beginning of the nineties, with promotional efforts of *Proyecto Desarrollo del Bosque Latifoliado* (PDBL, a Honduran-Canadian project) that groups regained strength, conducted inventories, became legally constituted, and implemented the beginning elements of more rational forest use.

Some 55 operations currently exist, with a total management area of 90,000 hectares. Each forest operation covers between 300 and 7,300 hectares, with most of them between 1,000 and 2,000 ha. The annual cutting potential of these

areas (considering all species) varies between 800 to 5,000 m³, with most operations between 1,000 and 3,000 m³.

All of the groups have experienced fluctuating membership, partly due to constant modifications of rules imposed by AFE-COHDEFOR. Currently, the groups have between 10 and 40 members (average 15).

The groups have a very simple internal structure. Generally, there is one functional position, the president, elected for one or two years. Sometimes, tasks, such as sales, are delegated to other members. A portion of the income from wood sales stays in the society for common expenses (transport costs, travel expenses etc). The president has to negotiate with AFE-COHDEFOR to obtain permits and represent the group. Practically all the groups use the same extraction procedures: Felling the tree, cutting planks with chainsaws, and subsequent transportation on mules. The better-organized groups have received small sawmills from PDBL that are in the testing stage. The idea is to promote greater vertical integration. Implementation of management plans and annual operational plans has waned due to AFE-COHDEFOR's financial problems, being partially replaced by other organizations, especially PDBL. The good forestry management certificate awarded by Rainforest Alliance/FSC to COATLAHL has been renewed, which means that groups belonging to this organization have been able to maintain their management levels to a certain extent.

b) Quintana Roo: the **ejidos**. The ejido is a communal form of land ownership that was promoted in Mexico for more than five decades and which currently includes more than 95% of the forested areas of Quintana Roo. The ejidatarios, usually the men who founded the community, or their heirs, make joint decisions about land use. The first forestry ejidos of Quintana Roo were established in the thirties and forties. The main economic activity anticipated was harvesting *chicle* (the raw material used to produce chewing gum), which did not imply forest conversion. These ejidos were provided with large overall forested areas (between 20,000 and 90,000 ha). The ratio between total

BOX 15

Noh Bec, a forest *ejido* in Quintana Roo

Noh Bec was legally established in the forties as a chicle *ejido*: large surface area (currently more than 17,000 ha of forests) and a high ratio of forest area per *ejidatario* (approximately 400 ha per *ejidatario*). In the fifties, a timber firm began to work in the *ejido*, mainly extracting **mahogany**. The members of Noh Bec participated in the silvicultural labour and in extractions carried out by the firm, learning the details and understanding the business. In the seventies, many families from outside the *ejido* settled here, significantly increasing the population. This, and the proximity to the federal highway, facilitated the early introduction of infrastructure (schools, electricity, health centres). However, the official programmes for changing land use were not very successful: the chicle forestry culture was firmly rooted in the *ejido*. When in 1981 Noh Bec obtained timber usufruct rights, it was discovered

that, unlike many other *ejidos*, there was still a considerable volume of **mahogany** (more than 1,200 m³ annually). All of these elements (a culturally homogenous population, forestry orientation, knowledge of silvicultural issues and extractions, large forested area, a high **mahogany** volume, importance of other forest products, access to formal education, good infrastructure) added to organizational skills and the innovative will of the *ejidatarios* have paved the way for Noh Bec. Today, the *ejido* has machinery for extractions, two saw-mills and a carpentry workshop (employing more than 170 people) and continues to obtain the greatest part of its income (1999: 1,500,000.- usd: 2,000.- usd/*ejidatario*) from forestry activities. The *ejido* has also successfully entered into processing lesser-known species, which today account for more than 60% of extracted volumes.

surface and number of families was high (more than 400 ha per *ejidatario*). These are the *ejidos* that have retained the most forested areas (between 30 and 80% of total area).

A second group of *ejidos* was established in the seventies. These are generally smaller than the first (between 5,000 and 20,000 ha) and the ratio between the *ejidal* area and the number of *ejidatarios* is smaller (approx. 80 ha). The main activities that were anticipated were cattle ranching and agriculture, that is, conversion of forests was part of the concept. These *ejidos* retained only small patches of forest.

In general, the *ejidos* grew slowly, integrating both the *ejidatarios*' sons and new arrivals. However, there are also *ejidos* that do not accept new *ejidatarios* and where *ejido* rights are strictly hereditary.

The *ejido* as a forestry operation is characterized by both community and productive functions,

which can lead to various problems. The legal structure of the *ejidos* is similar to the collective societies in the Atlántida. The assembly of the *ejido* elects three executives, who represent the *ejido*. The *ejidatarios* meet every month to discuss common business and to monitor the actions of their leaders. In some *ejidos*, various supplementary institutional structures have been formed. In some *ejidos*, new functional structures emerged. Other *ejidos* just split into various groups that manage certain steps of the extraction process on their own (see chapter 8.2.1). Currently, there are about fifteen primarily forest-oriented *ejidos* (i.e. *ejidos* where forest exploitation is the main source of income). These *ejidos* have annual potential harvest volume between 2,000 to more than 15,000 m³ (i.e. they are clearly bigger than the collective societies in the Atlántida). In forty other *ejidos*, more important economic activities exist, but forest op-

erations contribute significantly to the community's income. These ejidos have annual potential harvest volume of less than 5,000 m³. Many ejidos from the first group have large forested areas and important reserves of **mahogany**, and have managed to vertically integrate (extraction and sawing). Unfortunately, this first group has not grown. Rather, some ejidos from this group are losing industrial infrastructure due to low reinvestment and organizational problems. The ejidos of the second group struggle to maintain the status quo. In some cases, small **mahogany** volumes (after adjusting authorized volume to the real forest's potential) has led to the community to lose interest in forest operations, with a subsequent increase in illegal felling.

c) Reserva de la Biosfera Maya (RBM): The RBM has the greatest diversity in community operations. Three different groups can be identified:

- **Communities inside the multiple use zone of the RBM:** Here, all communities have received "community concessions", which include forestry usage rights. Every family in the community has a say in decisions about forest use. Benefits are equally distributed. The communities do not own their land, but have usufruct rights for long periods of time (more than 25 years). Forest composition varies greatly: some communities have considerable supplies of **mahogany** (e.g. Carmelita with 877 m³ annually), whilst others have practically none.
- **Operations in communities located outside the multiple use zone:** The eastern part of the RBM is practically uninhabited. These woods have been traditionally used by the population found along the highway that goes from Santa Elena to the border with Belize (i.e. communities outside the RBM), extracting non-timber products, such as palma de xate or chicle, or illegally felling trees. At the beginning of the nineties, a group of illegal *motosierristas* who live in Melchor de Mencos began to look for an opportunity to

legally harvest and mill trees. In 1997, the Consejo Nacional de Áreas Protegidas (CONAP) finally granted them a forest concession. Other groups followed.

Generally speaking, these groups have better managerial skills than the communities inside the RBM, in part because they have better access to formal education, a wider range of jobs, better services, and are less dependent on forest products. These groups were also formed with a clear objective to produce and, unlike the communities, do not concern themselves with community matters.

- **Cooperatives.** All along the Usumacinta river and the Río de la Pasión (i.e. the buffer zone of the RBM), various cooperatives were set up with significant forest areas. Unlike the groups mentioned previously, who only have usufruct rights, the cooperatives own their lands, which broadens their land use options. Some cooperatives divided their land into plots, which has made an annual forest management plan based on area-based harvesting impossible, and obliges them to seek solutions based on management of small forest properties. There are also significant differences in the internal organization of the co-operatives; For some, any form of organization has almost completely disappeared and given way to individual management of the forests, while others maintain an internal organization which is not only concerned with productive matters, but also resolves diverse community problems. The best example of this is Unión Maya Itzá (which should not be confused with Bio Itzá), situated on the southern border of the Sierra del Lacandón National Park. This cooperative has developed an impressive internal organization, in which both interest groups (e.g. women and young people) and the "barrios" of the village (probably with a certain ethnic predominance) have their own forums, which transmit their decisions to the executive committee. The tasks of directing productive activities (e.g. forest operations) is delegated to three-person committees. In

a similar fashion to the first Israeli kibbutzim, this organization bases its strength on the exceptional social conscience of its members. The discipline of people who were active in a guerrilla war struggle is undoubtedly a factor.

The communities of these three groups come from very different cultural backgrounds. While some communities inside the RBM have a long tradition of using non-timber forest products, the co-operatives have an agricultural and cattle farming background. Differences between community forestry operations can be notable, such as forms of extraction, vertical integration, and organization of activities. Added to this mix are differences in forested areas, volume of highly commercial wood, and organizational skills. The fact that more differentiation in timber extraction and processing has not occurred is probably because the operations have not existed for very long. Most of the operations are selling standing timber. Some also sell timber through a special agreement with a private enterprise, which allows them to obtain the benefits of conventional sawing (see 7.4) and others sell chainsawn lumber.

d) In the RAAN, no forest operations exist as such, because indigenous peoples' traditional government is collapsing, with power going to the closest formal political body, which are municipal governments (see Box 7). Decisions about forest use are often made by outsiders (madereros and municipal employees) without consent of the community. The benefits of forest use for the community are limited and accrue to few.

The exceptions to this situation occur when a large company reaches an agreement with a certain indigenous group. In this case, all forestry activities fall into the hands of the company. Another important exception is the organizational work of *Fundación para la Autonomía y el Desarrollo de la Costa Atlántica de Nicaragua*, a non-governmental organization working in a forest community (see chapter 8.2.1).

3.4 Groups of forestry operations

In the RBM, the Atlántida, and Quintana Roo, members of community forestry operations have formed diverse second-level organizations. The objectives and work methods of these organizations vary considerably.

- *Atlántida. The Cooperativa Regional Agroforestal, Colón, Atlántida, Honduras, Ltda (COATLAHL)* was founded in 1975 as an organization of forest operations, created in the framework of *Sistema Social Forestal (SSF)*. Eventually it included more than 30 groups, but currently has only 11. This decrease is probably related to the exhaustion of commercial species in the forests and subsequent loss of interest in timber extraction. Currently, nine groups of COATLAHL have the FSC backed certification for good forest management. COATLAHL has a sawmill, dry kiln, and a carpentry shop that works with **mahogany, redondo** (*Magnolia yoroconte*) and some lesser-known species. The greatest volume is still sold as sawn lumber. Currently, the volume of wood managed by this cooperative is low due to the restrictive policies of AFE-COHDEFOR.

The *Asociación Nacional de Productores Forestales (ANPFOR)* appeared two years ago as an alternative to COATLAHL. This organization is only just beginning and has not taken over any technical tasks.

- *Petén.* In this region, the diversity of community operations' and technical associations has prevented greater horizontal cooperation. However, the cooperatives from the west of the Petén, who are advised by the same technical organization, have formed a joint organization, the *Sociedad Comercializadora Agroforestal (SCAF)*, through which some forest and agricultural products have been commercialized.

In the last few years, another horizontal organization of community operations with outside funding has appeared, the *Asociación*

de Comunidades Forestales de Petén (ACOFOP). The actions of this organization have led to conflicts with technical assistance organizations. The ACOFOP has often defended populist positions, such as the idea that community operations, with a little training, could carry out any type of silvicultural work; in this manner questioning the need for professional forestry technical assistance.

- *Quintana Roo*. A large number of second-level organizations working in forest ejido

issues exist. The oldest are the Uniones, organizations that, in their time, were used to politically control the ejidos. Between 1986 and 1992, new organizations were formed with more technical, and less political, leaning: the so called *Sociedades Civiles*. Today there are four sociedades civiles, grouping more than 50 ejidos. Their objectives are to supply forestry technical services, create a common marketing platform, and improve lobbying.

4 TROPICAL HARDWOOD PROCESSING CHAINS

4.1 Development of industrial infrastructure in the study regions

The regional *primary and secondary processing industry* has a special importance for forest operations: its geographic proximity brings many advantages in terms of costs, information feedback, common standards etc.

In the sixties and seventies (with the exception of the RAAN, where industrial growth began in the nineties), a significant wood processing industry was set up based on **mahogany**. In Quintana Roo and the Petén, numerous sawmills and some plywood production plants were set up. In Quintana Roo, the growth of Cancun encouraged establishment of doors and furniture companies, whilst in the Petén –a remote region far from Guatemala’s national markets– only two medium-size secondary-processing industries appeared. In the Atlántida, substantial regional demand and a unique policy of industrial promotion, at the center of which was state control of sawing, resulted in a rapid growth of secondary industry, with motor-sawn **mahogany** supplied by community groups. Currently, the Atlántida has the greatest number of secondary processing industries of all the study regions.

In Quintana Roo and the Petén, the growth of forestry enterprises in the sixties and seventies was, to a great extent, based on privileged and

cheap access to **mahogany**. High demand for this wood meant that large profits could be made with relatively little investment. Because the key to this business was not the processing aspect, but access to resources, the region’s sawmills stagnated technologically and soon fell far behind compared to international standards. The growth of secondary industry in the south of Quintana Roo took place in an economic “boom”, basically owing to the spectacular growth of Cancun. When this “boom” came to an end, companies realized how weak their competitive capability really was.

The eighties and nineties were decades of crisis for traditional processing industries, basically due to two factors:

- On the one hand, the introduction of community forestry schemes severely limited short-term timber supply. Based on new inventories, community forestry technical assistance groups felt obliged to restrict the volume of **mahogany** authorized for extraction. Furthermore, community operations with the greatest **mahogany** volume soon vertically integrated in order to saw their wood and sell outside of the region, thus further reducing regional supply.
- On the other hand, the fall in spending power caused by the economic crisis in the four countries studied, elimination of trade

barriers and simultaneous modernization of national trade (which brought more competitive products into the regions) all led to major marketing problems.

These changes created a competitive situation that regional enterprises were not ready to face. In particular, the management of these enterprises made some very costly mistakes and many businesses had to close or decrease production. At the end of the seventies in Quintana Roo, 10 primary processing and 20 mixed primary/secondary processing enterprises existed. Of the former, eight ceased operations during the eighties and were later sold to the communities. Of the latter, 18 closed down and never opened again.

In the Petén and the Atlántida, the industrial crisis began in the nineties when those countries opened their borders to imported goods. Currently, all plywood plants are closed. Secondary processing enterprises in the Atlántida, with their important regional market, fared better, but there is always the danger of closures there too, with many companies working far below their installed capacity.

In the Petén, the industrial infrastructure is basically what is left over from industrialization in the seventies and eighties. Even if this infrastructure is no longer ideal for the forests' potential and has not been upgraded for nearly a decade (except in a few cases), it is still important in regional terms.

The nineties have seen the opening of modern flooring factories in the Atlántida, Izabal (the neighbouring region of the Petén) and Quintana Roo. These enterprises are extremely important for utilization of lesser-known species, because they can use heavier species not currently used for furniture production. These enterprises were set up in the new climate of economic openness and are different from traditional businesses: They are focused on markets outside the regions, and have a greater financial and managerial capacity. In general, they are businesses that were designed to grow within the new regional setting, whilst the traditional enterprises have had great difficulties adapting to it.

Some industrial growth has taken place in the RAAN over the last ten years. Generally speaking, this has consisted of portable sawmills working with **mahogany or cedro macho**. Two large companies exist: A plywood factory and a sawmill. Both enterprises control the timber extraction process. The sawmill also has a mouldings production line.

In all of the countries studied, *motosierristas* produce rough cut beams and planks on the felling site. Additionally in Mexico, *durmienteros* cut railroad ties by axe.

The development of regional *forest products trade* is analogous to the development of processing companies:

- Madereros have supplied processing companies in good times and in bad, often working illegally. The often changing business environment has hindered their growth and formal consolidation, therefore limiting their capacity to cover typical trade functions (storing, financing, distribution, and grading).
- Since so many sawmills are part of vertically integrated operations, lumber traders form a rather small group and are generally based in the countries capitals. They have always been interested in **mahogany** or other high-value species, and never had the marketing power to actively promote lesser-used species.
- Many furniture retailers settled in regional capitals in the fifties. Bad roads and primitive distribution infrastructure elsewhere protected the regional products from external competition. This has changed and today these companies must compete with large national and international companies that no longer work with local woods (see also chapter 6.4 and Box no. 16 and 34).

4.2 Common characteristics of regional production chains

A production chain is the sequence of processing and distribution stages from a certain raw material to finished products. Production chains are

the “channels” that take raw material, in this case tropical hardwoods, to markets. The competitiveness of such a chain depends on the competitiveness of the companies involved as well as on the quality of the relationship between companies, both of which in turn depend, at least in part, on the quality of regional services, networks, and infrastructure. Production chains can break if a company decides to supply itself from other sources (e.g. with South American instead of regionally produced lumber).

The production chains in the study regions have been exposed to extraordinarily rapid and drastic changes. Four out of the ten production chains identified developed less than five years ago. Three of the production chains will probably disappear over the next five years. Within the chains, relationships are volatile. Most business relationships are younger than ten years, something that would be unthinkable in the United States or Europe.

The production chains in the study regions basically differ in terms of the division of labour between community operations and private industry (i.e. who controls which production steps?) and in the technology they use for sawing.

The division of labour that develops after consolidation of communal forestry depends on various factors. There are large differences between community operations themselves, both in terms of their internal organization, and size and potential of their forests, which in turn affects their capacity to consolidate their presence in specific links of a production chain:

- Well-organized community operations with significant **mahogany** reserves will soon buy equipment for extractions and sawing.
- Forestry operations with organizational problems, but with attractive volumes of **mahogany**, generally do not bother to buy their own extraction equipment and sell standing timber to private enterprises.
- Community forestry operations that are not attractive to private industry, owing to their low volumes of commercial timber, or those enterprises which are not content with selling standing timber, but do not have the

means to invest in heavy machinery, can saw timber in the forest, using chain saws, axes, or portable sawmills.

The characteristics of the resulting chains are described below.

4.3 Production chains in which private companies control extraction and primary processing

There are two situations where private companies control extraction and primary processing:

- Private companies obtained concessions of state forests. This is the traditional wood extraction scheme, in which the company controls every step of the production process, and actively or passively excludes local communities. In the study regions, only two companies have this situation, both in the RBM. The two companies do not have problems controlling forestry activities; they only have to be concerned about possible *campesino* invasions.
- Private companies buy standing timber from poorly-organized community operations or from operations not interested in extracting certain lesser-known species. This is the dominant form of production in the RAAN. In Quintana Roo, some 35 community operations sell in this way.

In both situations described above, the private companies involved generally show a high degree of vertical integration. The issue that makes “traditional” concessions unfeasible is the fact that the companies are not in a position to prevent *colonos* from felling the forest in order to take possession of the land. The involvement of the communities in extraction activities makes these conversion activities more difficult. This could be the answer to ensure conservation of the forests. When the private industries that control extractions are small, forest extractions are often poor quality (i.e. these enterprises “cut and run”).

The communities involved in these chains have a limited influence over the quality of forestry activities and receive limited benefits from forestry operations.

In general though, it is in these situations that the range of species used has been expanded. To a great extent, this is due to the fact that the sawn lumber produced is offered at lower prices than lumber from situations where community operations have greater control, thus increasing sales opportunities.

Once again, the discordance between the managerial advantages, and the social and possible ecological disadvantages of this type of production chain, must be stressed. When a company owns or controls its wood supply, it is more efficient from a managerial and financial perspective, which is why some of these enterprises have been more successful in introducing new species. The problem is the limited control that these companies can exercise over forest conversion activities.

4.4 Chains where community operations control extractions and sawing

The most successful community operations (usually those that are well-organized and with large **mahogany** reserves) have managed to integrate vertically, buying equipment for extraction and sawing. In Quintana Roo, at least ten ejidos with sawmills exist. In the RBM, one operation has bought a sawmill. In the Atlántida, a cooperative of forestry operations (COATLAHL) has set up sawing activities and offers this service to its members.

The production of sawn lumber by community forestry operations has not always suited the interests and potential of private industry in the study regions. On the one hand, many private companies already have their own equipment for extraction and sawing, and are not willing to give up control over these production steps. Even when companies are forced to buy lumber, for example when they do not have extraction permits, business has rarely prospered with community operations because the latter group prefers to sell

the most valuable species (e.g. **mahogany**) to buyers from outside of the region, who pay more, give down-payments, and take all the timber at the beginning of the season. The private companies without extraction permits therefore are limited to buying what is left of the **mahogany** from the smaller operations.

Extraction and sawing activities in community operations normally have specific organizational and managerial deficiencies that make technical and managerial innovations more difficult than in private industry. In general, the result has been higher prices, greater problems with quality, worse service and, in some cases, a more limited range of species processed.

However, it is usually the case that the production controlled by community operations can bring greater social benefits, more control over deforestation, and better forest management.

4.5 Production chains based on chainsawn lumber or hand-hewn beams

Communities with less well-developed organizational skills or no investment capital still have the opportunity to produce chainsawn lumber, either with a chainsaw or a chainsaw with guide (Alaskan saw) or hand (axe) hewn beams. Pit saws (operations that manually saw logs placed over a pit) are no longer used in the regions. Chainsawn lumber and hand hewn beam producers usually sell to middlemen (“madereros”), who in turn sell to secondary industry. Flores Ricardez (1991) among others, has shown that the benefits of this type of processing are as high or higher than those obtained from conventional sawing due to low “external” production costs (e.g. gas, depreciation, and spare parts).

Currently, chainsawn lumber is the dominant form of production in the Atlántida. Considering the degree of development that the secondary industry achieved in the seventies, it can be deduced that obtaining supply in this way worked well. However, today it is clear that this method also brought about overexploitation of **mahogany** in the Atlántida region. In Quintana Roo, the pro-

BOX 16

Will the production chains be broken in the Atlántida?

The Atlántida region has the most important secondary processing industry of all the regions studied. It is basically a furniture industry, with some small-scale door manufacturers. Five large companies exist, alongside more than twenty medium-sized companies, around thirty-five small enterprises and many micro industries. The large companies export high-quality furniture to more than ten countries. Secondary processing industry in the Atlántida is at risk. Dangerous competitors have appeared in almost all markets, who are increasing their market participation in an alarming fashion. In the foreign markets, especially in the USA, South-east Asian and Chinese furniture companies are increasingly penetrating former Honduran strongholds. In the regional furniture market, commercial warehouses recently established in San Pedro Sula are altering the competition in different markets: in the furniture market for people with low to medium incomes, they are selling furniture produced outside the region (often made from metal) at very low prices. In the market for people with medium to high incomes, new commercialization channels have been opened (Wal Mart, etc.), offering furniture with more modern designs and a better finish. The reaction of regional companies to this new situation has not been productive; instead of reacting in the face of these new trends, regional enterprises have unleashed a price war amongst themselves to keep the remaining segments. This has clearly reduced their ability to react.

The situation for industry is especially difficult because at this time no regulations or assistance are being offered by the respective government bodies. The actions of AFE-COHDEFOR are often far removed from what actors in the productive chain are doing: they restrict the extraction groups, criminalize timber-merchants, and cause furniture producers to lose sleep at night with rumours about total bans on extractions. There is still a long way to go before they are able to establish strategies which would

permit sustainable timber supplies and promote better mechanisms for buying and selling.

Extraction groups, timber merchants and secondary industry have not found a joint platform to resolve their problems. Therefore, the most serious deficiencies of the chain remain: lack of communication between links, lack of innovation, funding difficulties, and the small size of companies. If things continue in this way, the opportunity which the forestry-timber sector represents for the Atlántida region for better resource management and economic development, will soon be lost. If trends continue, the current production chain will break: a large number of companies will disappear over the next ten years. Some of the surviving enterprises will have stopped obtaining supplies from community groups, preferring instead to import timber.

The Atlántida is undoubtedly the study region with most to lose in economic, social and ecological terms if the deficiencies in the current production chain are not corrected. It is vital that all actors understand what is at stake. The companies and workplaces lost over the next few years will not be replaced for a long time. It is important that everyone concerned realizes that these values can be saved with intelligent policies and a real contribution by all. The principal recommendations are:

- Recognize timber merchants as an important link in the productive chain.
- Give real support to community forestry production (legal situation, applying for permits, establishing an effective forestry service, technical support for sawing and timber extractions).
- Improve information about volumes and species available at a regional level.
- Support small and medium businesses in order to increase their marketing and production capabilities.

duction of railroad ties was for many years a source of income for the Mayan population. In the RBM, some groups still exist who produce lumber or cants using chainsaws with guides (Alaskan saws).

In practically every case, production chains involving chainsawn lumber and hand hewn beams are at risk. The low quality of the lumber is a central problem. Another factor is that these forms of production are frowned upon by others in the forest products industry, such as technicians and marketers, meaning that little effort is made to improve them. Traditional forms of buying and selling, unreliable supply, and late deliveries are also negative elements. In the Atlántida, the Sociedades Colectivas have replaced pit sawing with handheld chainsaws, but have not yet introduced guides for the chainsaws, therefore producing lumber with very uneven edges. The lumber is also smaller because it is transported by mules. These two factors mean that recovery from resawing is low (< 75%). On the other hand, nobody can guarantee a consistent timber supply, a deficiency for which AFE-COHDEFOR is partly to blame because its procedures for granting extrac-

tion permits are so convoluted. In Quintana Roo, railroad crosstie production has almost totally disappeared because producers cannot comply with the new procedures for buying and selling, and new quality standards demanded for this product (see Box 29). In the Petén, legal motor-sawn lumber production is decreasing in favour of conventional sawmilling.

4.6 Community operations - private industry cooperative partnerships

A partnership between community operations and private industry has developed in the RBM and represents a unique “experiment”: Various forestry operations and a private business share costs, risks, and income from the steps which they jointly control, which range from forestry tasks to the production of lumber and plywood. The partnership began with a forestry group with good organizational skills (Suchitecos) and is now being broadened to include other operations. This partnership is described in greater detail in chapter 7.3.

5 CURRENT MARKETS FOR LESSER-USED SPECIES

5.1 Historical trends in markets for lesser-known species

Two different types of markets can be identified for lesser-known tropical species from the study regions:

- Markets for **mahogany** and **cedro** substitutes. These are generally markets for furniture, doors, windows and decorative plywood, amongst others.
- Markets which are independent of **mahogany**. **Mahogany** was never the ideal wood for certain uses (heavy construction, floors and piers), which is why other woods were traditionally used. Heavier woods were usually chosen which were also resistant to rot and termites. To this can be added the use of timber for plywood core stock.

Historically, these two uses have developed in different ways. While in regional markets the demand for some **mahogany** substitutes has increased, the species with independent markets have seen their demand rise and fall.

5.1.1 Developments in mahogany substitute markets

Mahogany is the traditional commercial species in the forests of the study regions. This species has

been subject to overexploitation for a long time. When community forestry was established, **mahogany** reserves had already been drastically reduced compared to numbers inventoried at the beginning of the forestry operations. Moreover, many communities found themselves having to sell the small amount of **mahogany** they had left to obtain capital. Currently, more than 150 community forestry operations exist of which only a minority (about 30) have enough **mahogany** to be significant in commercial terms.

The decrease in **mahogany** in these regions has made timber buyers look for alternative supplies.

- Foreign buyers (United States and Europe) substituted “**Honduras Mahogany**” with Mahogany from South America (in both cases *Swietenia macrophylla*, although the Honduran wood is said to be better), but also with **Carapa** from South America (*Carapa guianensis*), **African mahogany** (*Khaya*, *Entandophragma*) and species of the **meranti** group (*Shorea*) from South-East Asia; i.e. they simply stopped buying in these regions.
- National buyers from Guatemala, Honduras and Mexico have substituted **mahogany** with species from many different places: South American **mahogany** (various species, not necessarily meliaceae), **palo blanco/pri-**

mavera (*Tabebuia donnell-smithii*) from their country's Pacific coast, and hardwoods from the United States and South America. Only in two cases has **mahogany** been substituted for a species from the same region in significant quantities: by **santa maría** (*Calophyllum brasiliense*) in the Petén and **cedro macho** (*Carapa guianensis*) in the RAAN.

- Regional lumber buyers are important in two regions: Quintana Roo and Atlántida. A different process took place in each region: In **Quintana Roo**, where no direct **mahogany** substitutes exist and where shortly after the consolidation of community forestry (and the decrease in **mahogany** volumes) the country opened up its markets, secondary industry based on **mahogany** practically disappeared (except for micro industries). In **the Atlántida**, diverse direct **mahogany** substitutes exist and there is an important demand for final products, which includes painted furniture (where the type of wood cannot be recognized by end consumers). Micro and small, and sometimes medium industry has substituted other species from the region for **mahogany**, while some medium and large-scale industries are obtaining **mahogany** from the Mosquitia Hondureña.

In summary, a substantial number of buyers (especially those outside the regions themselves) have dealt with the decrease in **mahogany** by finding supplies from elsewhere, either of **mahogany** or other species; i.e. that only in a few cases was **mahogany** substituted by species from the regions. Woods which are used as **mahogany** substitutes to a great extent are:

- **Santa maría** (*Calophyllum brasiliense*) in Guatemala
- **Cedro macho** (*Carapa guianensis*) in Nicaragua
- Diverse species in the Atlántida.

Generally speaking, the species which substituted for **mahogany** are currently used for furniture and door production, and plywood. Uses and markets vary from region to region.

5.1.2 Independent uses of lesser-known species

There are some uses for which other species are clearly superior to **mahogany**: the construction of piers, truck beds, heavy constructions, some musical instruments, certain handicrafts, railway crossties, wooden floors and other special uses. These are the uses which are termed independent here; i.e. they are not linked to **mahogany** substitution.

In general terms, the demand for Mesoamerican timber for these uses has tended to decrease over the last fifty years. This is true for both regional and foreign markets.

Foreign Markets. Fifty years ago, a wide range of woods from Mexico and Central America was important to the United States. Woods such as *Pithecollobium*, *Aspidosperma*, *Brosimum*, *Calophyllum*, *Hymenaea*, *Simaruba*, *Terminalia (amazonia)*, *Vatairea* and many others were well known to timber merchants after the Second World War (Hess, 1950). In the same way, many German timber merchants, who are now retired, bought timber from this region. They know the region's species well.

Except for Nicaragua, where a significant volume of timber from lesser-known species continues to be exported as both sawn lumber and plywood, these timber flows have been significantly reduced. Sawmills that produce lesser-known species for foreign customers practically do not exist. One can only speculate, but the most likely explanation is that volumes of really interesting species (such as *Hymenaea*) were limited. To this can be added the rise of Southeast Asia as a highly competitive exporting region. Another factor could be declining **mahogany** reserves, which was possibly the species that made forest operations profitable.

Of the lesser used species that are still exported, most leave the country as semi-finished or finished products, especially floors and, to a lesser extent, furniture.

Regional and National Markets. There has been a decrease in the production of lesser-known

species in regional and national markets as well. A clear example is heavy construction, where medium and heavy species are being slowly replaced with alternative materials (metal, cement). The use of lesser-known species for truck beds, railway crossties, piers and musical instruments has also decreased. In Box 13, the development of lesser-known species use in Mexico is shown. It shows a drastic fall in volume: By 1997, consumption of lesser-known species in Mexico decreased to about a fifth of what production rates were twenty years before. This decrease can be explained in the following way:

- With the disappearance of broad-leaved forests in vast areas timber supplies have reduced. Regions like Quintana Roo, which have maintained significant forested areas, have not been able to replace the production of timber from other regions, which is why many regional markets have been lost. Secondary industry in these states, for example Jalisco (northwest Mexico), has started to work with hardwoods from temperate climates.
- Modernization processes (improvements in road infrastructure, modernization of trade and market regulation) described in the previous chapter have been another important factor, especially the new highways which have allowed new raw materials to be brought to the regions, and displace traditional materials (i.e. lesser-known species).

Even though the general trends in the four regions have been similar, consequences have been different:

1. Atlántida/Honduras: It appears that the general production of lesser-known species has decreased. In this case, it seems to have gone from a situation where a few species—especially **redondo** (*Magnolia yoroconte*)—were produced in high volumes to a situation in which a number of different species are produced in lower volumes.

2. RAAN/Nicaragua: Supplies of lesser-known species for Managua have traditionally come from the Pacific coast. Although these sources are running out, other regions, especially the Atlantic coast, are not in a position to supply them because of high transportation costs and general weakness of the timber trade. This results in the paradox of forestry producers who have no markets for their timber, and micro and small industries who have problems with supplies.
3. Petén/Guatemala: Far from important consumer centres, timber production of lesser-known species grew only with the establishment of plywood facilities: These plywood producers closed down for the most part after the opening up of Guatemala's markets due to external competition.

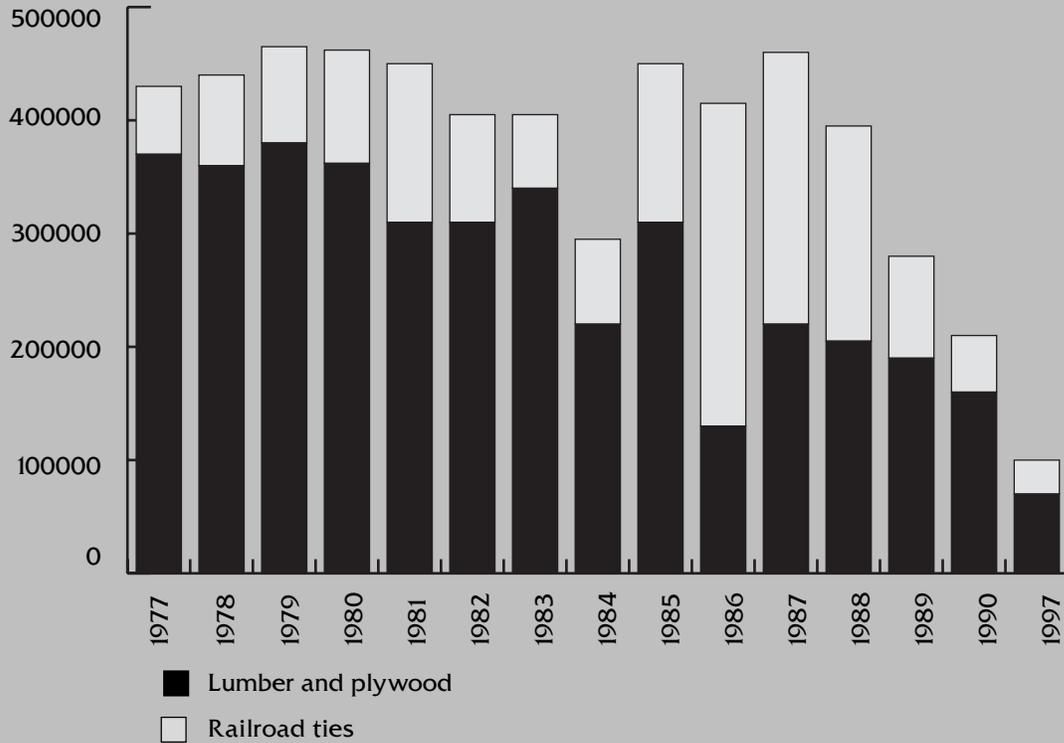
Despite decreases in general terms, some markets for lesser-used species have grown:

- Flooring: In Quintana Roo, the creation of a flooring factory and improvements in the management skills of some *ejidos* have been decisive factors. In Guatemala, a decrease in available volumes in the Izabal/ Río Dulce region and improved management skills of the community operations of the RBM were decisive factors in the decision of the flooring industry located in eastern Guatemala to buy timber from the Petén.
- Production of Painted Furniture: The popularity of painted furniture in the Atlántida has made it possible to replace **mahogany** or **redondo**; in Mexico, some kitchen cabinets are finished with car paint, where surfaces of light hardwoods bring better results than pine.
- Some volumes of export sales to “green” markets.

Unfortunately, the increase in timber consumption for these uses could not counteract the losses in other uses. Except for RAAN/Nicaragua, where exports and the production of **cedro**

BOX 17

Production of LUS in Mexico [m³]



macho (*Carapa guianense*) for national markets has grown considerably, it has to be said that instead of increasing with the fall in **mahogany** volumes, the production of lesser-known species has actually decreased in the study regions.

5.2 Timber volumes currently utilized

Existing information on the quantity of lesser-known species utilized at a regional level often suffers from methodological deficiencies in data collection. An initial estimate based on quantitative information and corrected according to various experts' opinions is presented in Box 18.

5.2.1 Petén

For the Petén, profound changes are foreseen in volumes of lesser-known species utilized because of problems in the plywood industry. For the years 1998 to 2000, approx. 60% of the volume of lesser-known species was destined for this use. This volume will decrease considerably in the future because plywood companies from the Petén are exposed to such a strong competition. The estimated volume of timber consumption for 1999 is shown in Box 19.

The data include quantities exploited in the buffer zone. The estimate is derived from the 48,039 m³ established in Box 11 and approx. 7,000 m³ from other sources.

5.2.2 Estimated volume harvested in the Atlántida (Honduras)

The data shown in Box 20 are based on sales of standing timber recorded by AFE-COHDEFOR for the extraction groups. It probably has some deficiencies.

In Honduras, forest producers have to pay higher royalties for commercial species than for lesser-used species. It is likely that some forest producers request felling permits for lesser-used species but fell more commercial species instead, transporting the lumber with the papers for lesser-used species, taking advantage of AFE-COHDEFOR's weak points concerning the control of forestry tasks and transporting timber. This implies a certain bias. Some lesser-known species that appear as extracted, may have been harvested in smaller volumes or not at all.

The numbers in box no. 20 demonstrate the large number of species used in the Atlántida. Here, mahogany is being replaced by at least five other species (technical substitutes).

5.2.3 Quintana Roo

No production statistics per species exist in Quintana Roo. Nevertheless, it can be stated that only

few species are currently used. Most of them have been present in national market for some time. Only few have been introduced lately by "green" traders.

While the use of species linked to flooring or furniture production like tzalam and sacchacah is increasing, the demand for other species like chechen (which is linked to railroad ties) has been diminishing.

5.2.4 Production by species in Nicaragua

No information is available for timber production in the RAAN. In box 22, the relevant species for the RAAN are underlined.

- The only case in which changes in volumes reported can be directly attributed to a change in the commercial situation of a species is the case of **cedro macho**, which in the nineties began to substitute for **mahogany**, making it the most produced species in 1999.
- Data referring to species such as **almendro** and **comenegro**, which are species that were not seen in any workshop, could be biased, given that many timber merchants

BOX 18				
Harvested volume of broadleaved species [m ³]				
Region	Current Annual Potential	Volume extracted annually		Total
		Light and Medium	Heavy	
RBM ^{a)}	49,500 ^{b)}	9,000	2,000	11,000
Atlántida ^{b)}	104,707	18,000	2,000	20,000
Quintana Roo ^{c)}	139,000	19,278	7,758	27,036
RAAN ^{d)}	360,000	20,000	5,000	25,000

a) Estimate based on data from CONAP (2000) for the seasons 1998, 1999 and 2000. The data include quantities exploited in the buffer zone. The estimate is derived from the 48,039 m³ established in Box 11 and approx. 7,000 m³ from other sources, less 5,578 m³ of mahogany.

b) Estimated based on diverse data.

c) Based on Semarnat (2000) for the season 1999. **Tzalam** has been counted as a medium weight species.

d) Estimate based on diverse data. It includes the cedro macho (*Carapa guianensis*).

Source: diverse sources.

BOX 19

Extracted volume of lesser-known species in the RBM

Species	Volume exploited
Light and medium-weight species for plywood (principally <i>Calophyllum</i> , <i>Pseudo-bombax</i> , <i>Bursera</i> , <i>Dendropanax</i> , <i>Lysiloma</i> , <i>Pithecellobium leucocalyx</i> , <i>Terminalia</i> and <i>Pithecellobium arboreum</i>)	5,600 m ³
Ramón (<i>Brosimum alicastrum</i>) for plywood	1,000 m ³
Heavy species for sawing (principally <i>Brosimum</i> , <i>Aspidosperma</i> , <i>Lonchocarpus</i> , <i>Astronium</i> , <i>Aspidosperma</i> and <i>Sweetia</i>)	1,000 m ³
Santa María (<i>Calophyllum brasiliense</i>) for sawing	2,800 m ³
Other medium-weight species for sawing (principally <i>Terminalia</i> , <i>Pithecellobium</i> and <i>Lysiloma</i>)	600 m ³

Source: Estimates based on assessments of regional producers.

use timber transport permits for lesser-known species to transport species of a higher value.

- The reported decline of **guanacaste** and **pochote** could be linked to a fall in production in the Pacific region, mentioned by several sawyers in Managua and Granada.

For several fairly commercial species such as **Santa María**, **botarrama**, **guayabo negro**, **Leche María** and **guapinol**, the volumes appear to have remained more or less constant from 1996 to 1999.

Nicaragua is the only country of those studied which shows a clear increase in exports (Box 23): The increase is, in our opinion, a result of the work of transnational companies (one is Agro Dos Ríos, see chapter 8.1.3) which export to Costa Rica and the Caribbean. In Costa Rica, the industry knows and works with a large number of species. In the Caribbean, where a high demand for timber exists for construction purposes, it has been relatively easy to introduce new species.

5.3 Principal markets

5.3.1 Markets for timber from the Petén

Regional Markets. In the Petén, standing timber is bought. There are no buyers for roundwood, plywood and limited buyers for lumber, so these products are sold outside the region. The principal markets for the Petén's timber have been central Guatemala, Mexico, the United States, Europe and the Caribbean.

National Markets. The central region, especially Guatemala City, is where the greatest volume of timber converges. Another important consumer group is the flooring and siding industry in the "East" (on the Guatemala - Puerto Barrios highway). In Guatemala City, every kind of timber industry exists: there are poor neighbourhoods like "La Florida" which have three or four small sawmills, and in every street is a carpentry workshop. All of this is characteristic of the informal sector. There is also an important formal industry, aimed

BOX 20

Estimated volume harvested per species – Atlántida Region

Common name	Scientific name	P.E. [g/cm ³]	1989 [m ³]	1995 [m ³]	1996 [m ³]	1997 [m ³]	1998 [m ³]
Light and medium species							
Mahogany	Swietenia macrophylla	0.42	11,970	1,468	1,433	2,411	2,026
Sangre	Virola koschnyi	0.36	*2,236	274	537	387	1,722
San Juan Areno	Ilex tectonica	0.46	467	807	1,383	2,564	1,441
Varillo	Symphonia globulifera	0.56	5	265	638	1,008	1,326
Barrenillo	Mortonioidedron	0.37	*745		25	146	1,248
Pino	Pinus oocarpa	0.55		272	344	607	1,129
Piojo	Tapirira guianensis	0.42		207	486	1,083	1,015
Huesito	Macrohasseltia	0.62		178	464	852	871
Rosita	Hieronyma	0.61	55	198	227	469	851
Redondo	Magnolia yoroconte	0.52	2,466	349	297	333	847
Santa María	Calophyllum brasiliense	0.52	*642	348	523	1,566	846
Cumbillo	Terminalia amazonia	0.64		391	536	1,314	553
Coloradito	Gordonia brandegeei	0.64		157	284	96	517
Ciprés	Podocarpus	(n.d.)	23	44	11	83	351
Cedro	Cedrela odorata	0.33	3,695	215	280	472	295
Marapolán	Guarea grandifolia	0.56		64	159	60	216
San Juan Peludo	Vochysia guatemalensis	0.41		119	477	148	209
Cedrillo	Huetea cubensis	0.37	124	31	167	155	177
Cincho	Lonchocarpus latifolius	0.6				50	142
Laurel	Cordia alliodora	0.44	2,726	88	61	132	141
Pepenance	Byrsonima spicata	0.44		30	306	218	135
San Juan Rojo	Vochysia jefensis	0.44		113	138	262	115
Cenizo	Mirandaceltis monoica	0.7				17	110
Aguacatillo	Ocotea caniculata	(n.d.)	*373	52	235	140	93
Amargoso	Vatairea lundellii	0.62			1	25	89
Barba de Jolote	Cojoba arborea	0.61		130	46	50	77
Zapote	Calocarpum mammosum	0.53				96	35
Urraco	Licania platypus	0.58				30	9
Almendro	Albizia caribaea	(n.d.)				47	9
San Juan Colorado	Vochysia ferruginea	0.38			3	22	
Liquidambar	Liquidambar styraciflua	0.51				122	
Aguacate	Persea americana	0.52			23	20	
Jigua	Nectandra hihua	(n.d.)	8	87	205		
Heavy species							
Celillón	Pouteria izabalensis	0.71			43	2,077	1,066
Vaca	Ampelocera hottlei	0.66		27	83	33	379
Bellota	Quercus skinneri	0.78				12	250
Masica/Masiquilla	Brosimum alicastrum	0.73				309	235
Pimientillo		(n.d.)				309	235
Paleta	Dialium guianense	0.85				60	130
Other species extracted			*1,585	11	141	520	804
TOTAL			25,535	5,925	9,556	18,330	19,694

* Species used principally for the production of plywood in 1989.

Source: AFE-COHDEFOR-ATLANTIDA; 1998. Data for 1989: Estimate based on AFE-COHDEFOR (s. f.), quoted in Instituto de Investigación y Formación Cooperativista (1993).

BOX 21

Estimated volume harvested of lesser-used species of Quintana Roo (2000)

Species	Exploited volume
Light and medium species	
Tzalam (<i>Lysoloma bahamensis</i>)	7,000 m ³
Sacchacah (<i>Dendropanax arboreus</i>)	6,000 m ³
Chacah rojo (<i>Bursera simaruba</i>)	3,000 m ³
Amapola (<i>Pseudobombax ellipticum</i>)	1,700 m ³
Negrilo (<i>Simarouba glauca</i>)	1,200 m ³
Other light and medium species	400 m ³
Heavy species	
Chechen (<i>Metopium brownei</i>)	4,500 m ³
Machiche (<i>Lonchocarpus castilloi</i>)	2,500 m ³
Other heavy species	750 m ³

Source: estimates based on assessments made by regional producers.

at both domestic and foreign markets. The industry manufactures household furniture and doors, kitchen cabinets, closets, office furniture, shutters, truck beds, pallets (generally a separate line for saw mills) and flooring.

For the Petén, the main obstacle to entering these markets has been the high transport costs. Ten years ago, the journey from Flores to Guatemala was an adventure which could last several days, not only because of the poor road conditions, but also because of multiple forest control points. The products from the Petén which could compete were those based on **mahogany**, because the market price was clearly higher than the cost of taking the products to Guatemala City. Products included sawn lumber, plywood and other products whose value was higher than transport costs, such as doors or siding.

Transporting timber has become cheaper over the last few years, not only because of better roads, but also because of a considerable decrease in corruption in the highway control. This opens up the potential to introduce new woods onto the market, especially heavy woods.

Markets for Light-Weight Woods: Most of the industries in central Guatemala do not, and the near future will not, buy lesser-known light-weight

woods from the Petén. In spite of decreasing transport costs, light woods are still sold at prices which are much higher than comparable woods from other regions. Not only the distance affects the price. In this market, the Petén has to compete against other Guatemalan regions which produce under different conditions (e.g. changes in land use, illegal felling or commercial plantations) which means that forest products from these regions can be offered at much lower prices. Roundwood markets are completely out of the question given the high transport costs. However, opportunities are no greater in sawn lumber markets, which is mainly used for furniture production.

The dominant wood in this market is **palo blanco** (*Tabebuia donnell-smithii*), from the Pacific coast, a well-known species found at all levels of furniture production, from the smallest carpentry workshop to the largest furniture companies. In all of these cases, the sales price is much lower than any potential substitute coming from Petén. One could maintain the "hope" that an overexploitation of **palo blanco** would raise its price, allowing wood from Petén to compete, but there are no signs that this species is becoming scarce. Besides there is growing supply from plantations. Large companies are now analysing

BOX 22

Estimated volume harvested of lesser-used species of Nicaragua

	Species	P.E. (gr/cm ³)	Volume exploited (m ³ /year)		
			1995	1996	1999
Light and medium species					
Cedro Macho	<i>Carapa guianensis</i>	0.47	1,595	19,659	26,194
Nancitón	<i>Hieronyma alchorneoides</i>	0.61		3,108	3,497
Santa María	<i>Calophyllum brasiliense</i>	0.53		4,559	3,034
Sebo/Banak	<i>Viola koschnyi</i>	0.45		n.a.	2,901
Ceiba	<i>Ceiba pentandra</i>	0.3		2,841	2,422
Botarrama	<i>Vochysia ferruginea</i>	0.38		n.a.	1,456
Guayabo negro	<i>Terminalia sp.</i>	0.51		n.a.	1,185
Leche María	<i>Symphonia globulifera</i>	0.56		n.a.	890
Palo de Agua	<i>Vochysia hondurensis</i>	0.34		n.a.	676
Coyote	<i>Platymiscium sp</i>	0.58		n.a.	575
Nancite	<i>Byrsonima crassifolia</i>	0.59		n.a.	482
Ojoche	<i>Brosimum terrabanum</i>	0.6		n.a.	460
Camibar	<i>Copaifera aromatica</i>	0.62		n.a.	452
Carolillo	<i>Ormosia sp.</i>	0.54		n.a.	405
Genízaro	<i>Pithecellobium saman</i>	0.53	2,849	*3,738	*371
Guanacaste negro	<i>Enterolobium cyclocarpum</i>	0.38	4,049	**15,229	**292
Mahogany	<i>Swietenia macrophylla</i>	0.45	2,987	***34,622	***0
Cedro Real	<i>Cedrela odorata</i>	0.33	2,540	12,184	0
Pochote	<i>Bombacopsis quinatum</i>	0.39	1,323	2,634	0
Guanacaste Blanco	<i>Albizia caribaea</i>		2,919	10,730	0
Heavy species					
Almendo	<i>Dypteryx panamensis</i>	0.85		n.a.	2,323
Guapinol	<i>Hymenaea courbaril</i>	0.78		2,907	2,166
Comenegro	<i>Dialium guianense</i>	0.83		n.a.	1,946
Areno	<i>Laetia procera</i>	0.68		n.a.	1,711
Níspero	<i>Manilkara achras</i>	0.89		n.a.	1,668
Guayabón	<i>Terminalia amazonia</i>	0.66		n.a.	992
Rosita/Manteco	<i>Sacoglottis trichogyna</i>	0.72		n.a.	930
Mora	<i>Clorophora tinctoria</i>	0.88		n.a.	549
Other hardwoods (in 1995 and 1996 the species listed above whose values per species were unavailable were included.)			6,943	20,604	3,966
Total hardwoods without mahogany and cedro			19,678	86,010	
Pino	<i>Pinus caribea and oocarpa</i>		49,081	134,483	13,373
NATIONAL TOTAL			71,367	267,299	74,918

* This species is used in metal/wood furniture production.

** These data do not represent the reality of the saw mills at a national level. Only one enterprise (Fundación la Providencia) bought 95 m³ of wood in log form of this species in 6 months, which would represent 32% of the national volume.

*** Although mahogany was officially banned in 1999, high volumes were seen in the saw mills, as well as the large quantities seen in the eastern market of Managua.

Source: Forestry Statistics Bulletin MARENA 1996 and Annual Report 1999 INAFOR.

the possibility of integrating **rubber tree wood** (*Hevea brasiliensis*), which differs considerably from **palo blanco**, and **melina** (*Gmelina arborea*), which appears to be very similar, into their production lines. These species are entering the markets at prices even lower than those of **palo blanco**. In the case of cheap furniture, the primary substitute for **palo blanco** is pine, which is offered at half the price of palo blanco. At all levels, solid wood is being replaced by particle board or medium-density fiberboard (MDF), which has the same or a slightly higher price than **palo blanco**, but can reduce manufacturing time. In summary, furniture markets for light-weight woods from The Petén are limited. It is the same for the kitchen cabinets, closets, mouldings, frames and pallet markets.

Another danger for light-weight woods is importation, which has gradually increased, amounting to about 86,3 million dollars, creating a trade deficit of 50.8 million dollars in 1998.

Mahogany and its direct substitutes: mahogany substitute markets are in the production of high-quality furniture. Direct **mahogany** substitutes are **santa maría** (*Calophyllum brasiliense*) and **cola de coche** (*Pithecellobium arboreum*). Both species have certain problems with drying, so they must be handled carefully. They compete directly against several reddish varieties from Guatemala's Pacific coast.

Door production is another market for the sawn lumber of these species. In this market, **santa maría** has been well accepted (see the discussion on the door market in the description of the markets for medium and heavy woods).

Mahogany plywood has suffered an important setback with the growing importation of plywood from Southeast Asia. Guatemala is experiencing what Mexico experienced almost fifteen years ago, when the country joined GATT. This trend is extremely important for lesser-known species which can be peeled, because producers used them in large volumes for the inner plywood layers, while using mahogany for the other layers. It will be difficult to recover lost markets: Imported plywood is sold at 25% less than plywood produced locally. This is equivalent to 2 USD for a 4 by 8 feet/one quarter (122 by 244 cm/6mm) sheet in wholesale trade.

Markets for medium and heavy woods: The prospects for medium and heavy woods look better than for light woods, because competition from other species, especially those coming from plantations, is much smaller. The flooring and entrance door factories are potential customers for timber from the Petén. In the production of entrance doors there is heavy demand for species which are durable and attractive. Traditionally this has

BOX 23

Exports of sawn lumber 1992 - 1999

Year	Nº of species	Volume m ³
1992	17	4,568
1993	16	7,209
1994	38	26,962
1995	38	55,390
1996	N.D.	91,236
1997	N.D.	112,581
1998	N.D.	83,153
1999*	N.D.	33,507

* Data from May 1999.

Source: Forestry Statistical Bulletin D.G.F. MARENA; CETREX, 1999. INAFOR, 1998.

been a market for **mahogany**. With time, **mahogany** substitutes, principally **santa maría**, have been used. Here, timber from the Petén competes with imported wood, especially in companies who export. One door factory works mainly with wood from the United States and Brazil, such as **oak** (*Quercus sp.*), **cerejeira** (**oak** substitute) and **andiroba** (**mahogany** substitute). The timber from the Petén could be offered at a lower price than imported woods, but the imported wood arrives properly-dried, with standard quality and no problems regarding supply. Many entrance doors are exported to the United States, where oak is the traditional wood that foreign producers try to substitute with their own woods. In general, for making entrance doors, **santa maría** (*Calophyllum brasiliense*) and **cola de coche** have been able to fill certain niches, but they are seen as second rate in terms of quality. Despite this, the market seems to be open to the idea of new species.

Several commercial businesses have begun to import doors. If they do not want to be displaced, medium and large-scale national producers need to rethink their strategies and restructure their supply and sales relations.

Another important use for wood from the Petén is in *flooring*:

- Small companies in Guatemala City specialize in the installation of floors with a wide range of species, such as **santa maría** (*Calophyllum brasiliense*), **chichipate** (*Sweetia panamensis*), **tzalam** (*Lysiloma bahamensis*) **danto** (*Vatairea lundellii*) and **teca** (*Tectona grandis*). These companies buy flooring strips from large producers in eastern Guatemala and parquet pieces from carpenters, who obtain this wood from unknown sources. Installers buy these pieces at low prices, but often have problems with the quality, because they are cut with very rudimentary machinery. Competition with other woods is much less in the flooring market because lateral hardness is required, which usually correlates with a high specific gravity. With the exception of teak (*Tectona grandis*), no plantation species is hard enough.

- Large flooring companies, located in the “east” i.e. on the Guatemala City to Río Dulce highway, are expanding, and their traditional source of supplies, the Río Dulce/Izabal region, is no longer sufficient for their demand, so these companies have now begun to buy wood from the Petén, as both sawn lumber and as logs, including species like **bálsamo** (*Myroxylon balsamum*), **chichipate** (*Sweetia panamensis*), **guapinol** (*Hymenaea courbaril*), **cola de coche** (*Pithecellobium arboreum*) and **cortez** (*Tabebuia guayacan*), as well as the species already mentioned for the small firms. However, demand varies according to the species: the large companies, which export, buy all the **bálsamo** and all the **chichipate** that they can lay their hands on, even importing these woods from Mexico. The demand for **guapinol** and **cola de coche** is also high. The other species are sold to small firms, who sell into the national market. Large enterprises have also tried species like **manchiche** (*Lonchocarpus castilloi*), but have not been successful in introducing them to their customers.

External Markets for Timber from the Petén.

Guatemala exports \$35.5 million dollars worth of forest products annually, mainly to Central America, United States, Europe, the Virgin Islands and, to a lesser extent, Asia. Even though **mahogany** from the Petén is important for these exports, most of them are based on wood which did not come from the Petén.

Mexico. As a market, Mexico has been as volatile as its currency. After each devaluation in this country, Mexican timber has entered neighbouring countries’ markets to be gradually displaced when inflation counteracts the effects of devaluation; i.e. timber exports from the Petén to this country are of a temporary nature. Currently, the general tendency is for timber to go to Mexico, but the volume handled is small due to the costs of transporting the timber through Belize, which are relatively high. This situation could radically change if the rumors are true, and a bridge is built over the Usumacinta river. In this case,

timber from the Petén would compete on equal terms with timber from other Mexican states such as Campeche, Chiapas and Quintana Roo, which would definitely have a significant impact on lesser-known species. The species which are commonly exported to Mexico are high value varieties and also some species for floors, like **tzalam** (*Lysiloma bahamensis*), **manchiche** and **bálsamo**. In the year 2000, Guatemala's sales to Mexico were primarily **mahogany**, while Mexico sold **bálsamo** and **chichipate** (called **cencerro** in Mexico) to Guatemala (mainly for flooring production in the east of Guatemala).

Europe and the United States. After a long pause in production in the Petén, former European and American buyers are starting to come back and to establish new commercial contacts.

These buyers are mainly interested in **mahogany**. It would be naïve to think that the lack of interest in lesser-known species is due to lack of knowledge (see chapter 5.1.2). It is rather the case that they know the principal species, but that they get better supplies of similar species from other parts of the world.

On the other hand, "green" buyers are more interested in lesser-known species: without a doubt, certification opens up a "window of opportunity" for lesser-used species. In general, green buyers have been principally interested in what are known as exotic woods; i.e. wood with an extraordinary colour or grain, which can be used for "high end" purposes like musical instruments, artistic uses, fine furniture etc. There are two reasons for this:

- The prices of the timber being offered are not competitive in the construction market or for industrial use, and the volume is insufficient for mass markets.
- Exotic timber markets are markets where the green stamp has a special significance.

The possibility of selling certified timber has awakened some interest and is currently a potential market for significant volumes of sawn lumber of lesser-known species.

5.3.2 Markets for hardwoods from the Atlántida

The Atlántida region is the study region where the greatest number of lesser-used species have entered the markets, basically in regional markets. This is due to a large number of species which can substitute **mahogany**, a significant regional secondary industry and proximity of manufacturing and consumer centres, which facilitates trade (legal and illegal).

Regional Markets. Chainsawn beams and planks are the principal commercialized product. Markets for lumber sawn in sawmills are small because most secondary processing enterprises resaw the lumber with their own machinery or deliver it to resawing companies (*maquila*). The region is an important consumer centre for finished products. In San Pedro Sula and in La Ceiba, especially, one can observe diverse distribution channels for household furniture. In La Ceiba small and "micro" carpentry workshops predominate which sell directly to final consumers or distribute to traditional trade warehouses. In San Pedro Sula medium-sized enterprises sell through furniture "boutiques", where imported furniture is also offered, and large companies sell through furniture stores. These three distribution channels are the most important for lesser-known woods. Another important market is for doors and windows, which are still supplied by small and micro enterprises. Custom kitchen cabinets and closet markets are being threatened by distributors of products from outside the region, but small manufacturers still dominate. Office furniture has been made with products from outside the region for a long time.

A large number of species suitable for furniture manufacturing exist. In view of the reduction in **mahogany**, micro, small and medium processing enterprises have not hesitated to use these other species, relying on the lower expectations of their customers. A factor that has motivated use of lesser-known species is the high demand for furniture painted black, where diverse species can be "hidden". Even so, clear preferences obviously exist:

SPECIES WITH A CONSOLIDATED DEMAND: Forestry producers and *madereros* know they can easily sell

these species to the secondary industry: **redondo** (*Magnolia yoroconte*), **laurel negro** (*Cordia megalantha*), **marapolán** (*Guarea grandifolia*), **san juan areno** (*Ilex skutchii*), **cedro** (*Cedrela odorata*), **sangre** (*Pterocarpus sp.*) and **varillo** (*Symphonia globulifera*).

SPECIES WITH AN IRREGULAR DEMAND: Madereros sometimes buy these woods even when they do not have any orders for them: some of these species have been known for a long time, others are new: **naranja** (*Terminalia amazonia*), **santa maría** (*Calophyllum brasiliense*), **rosita** (*Hieronyma alchorneoides*), **huesito** (*Macrohasseltia macroterantha*), **pochote** (*Bombacopsis quinatum*), **barrenillo** (*Mortonodiedrum anisophyllum*) and **ciprés** (*Podocarpus guatemalensis*).

SPECIES WITH AN INCIPIENT DEMAND: madereros only buy these species if they have received an order for them: **paleta** (*Dialium guianense*), **celillon** (*Pouteria izabalensis*).

OVERUSED SPECIES (currently no trade allowed with these species): **granadillo** (*Dalbergia sp.*), **guayacan** (*Guaiacum sanctum*), **carreto** (*Samanea saman*), **carreto real** (*Albizia guachepele*), **cortez** (*Tabebuia guayacan*), **san juan guaya-peño** (*Tabebuia donnell smithii*).

Central Honduras: Tegucigalpa is a surprisingly small market for hardwoods, especially for lesser-used ones. Pine predominates in all uses and is produced on a scale, and with technology, far superior to hardwoods. In the city there are fewer than ten medium or large enterprises that buy hardwoods, and of these, most are only interested in **mahogany**.

Foreign/external markets. There is a prohibition on exporting sawn lumber. Rumors exist that small amounts of sawn wood are still exported. Most wood leaves the country as furniture parts or semi-finished or finished furniture, generally produced with **mahogany**.

5.3.3 Markets for species from Quintana Roo

In Quintana Roo some 12,000 m³ of light-weight woods are produced annually, basically of four species: **sacchacah** (*Dendropanax arboreus*),

chacah (*Bursera simaruba*), **negrito** (*Simarouba glauca*) and **amapola** (*Pseudobombax ellipticum*). The *ejidos* sell almost 70% of this volume in log form (some 8,500 m³ annually). The rest (around 800,000 board feet per year) is sold as lumber by the *ejidos* who own a saw mill.

In Quintana Roo some 14,000 m³ of medium and heavy wood are produced annually, mainly **tzalam** (*Lysiloma bahamensis*), **chechen** (*Metopium brownei*) and **machiche** (*Lonchocarpus castilloi*), while **pucté** (*Bucida buceras*), **catalox** (*Swartzia cubensis*) and **chaktekok** (*Sickingia salvadorensis*) are produced in lower quantities.

The *ejidos* with sawmills sell their timber as lumber. The *ejidos* that do not have sawmills sell logs to local saw mills, which process them and then sell lumber to the regional or national market. Quintana Roo is the second largest state in terms of heavy-weight sawn wood production in Mexico, surpassed only by Campeche.

Regional markets. The main cities are Merida, Cancun, Campeche and Chetumal. Most light-weight roundwood produced in Quintana Roo is sold here. The main buyers are a factory in Felipe Carrillo Puerto and another in José María Morelos, both in the centre of Quintana Roo. Some timber produced in the north of the state is sold in Tizimín, Yucatán, where it is processed for panels and plywood. **Sacchacah** (*Dendropanax arboreus*) is a special case, which because of its organoleptic characteristics (it is tasteless) is used for the manufacturing of ice-cream spoons, tongue depressors and toothpicks in a factory located in the state.

In Quintana Roo, the market for lumber made from light-weight woods is limited. Some companies located in Cancun and one located in Chetumal produce furniture, flooring, windows, decks and mouldings. These products are sold locally. In the nineties, the flooring factory located in Chetumal was an important customer for sawn light wood, which was used for the centre of laminated parquet. The factory has now replaced these woods with pine from the centre of the country. In any case, the factory represents a potential market for more than one million board feet per year. The same phenomenon was found

in the Cancun region, where light woods were used for concrete forms in the construction industry. Currently, third-rate sawn pine is used or 19 mm plywood, also pine, because they are cheaper.

Amongst medium and heavy woods, **tzalam** (*Lysiloma bahamensis*) (furniture and flooring), **machiche** (*Lonchocarpus castilloi*) and **chechen** (*Metopium brownei*) (floors) have a stable market. The main regional buyers are flooring companies located in Chetumal and diverse furniture companies located in Cancun. These firms generally buy lumber. Many other species such as **ramón** (*Brosimum alicastrum*), **bayo** (*Aspidosperma sp.*), **pucté** (*Bucida buceras*) and **jabín** (*Piscidia communis*) show an erratic and limited demand, generally for flooring or building.

Different species such as **chicozapote** (*Manilkara zapota*), **chakteviga** (*Caesalpinia platyloba*), **yaití** (*Sideroxylon gaumeri*) and **bayo** (*Aspidosperma cruentum*) are used to build *cabañas* and other constructions, especially in the tourist market, owing to natural characteristics of strength, durability and a straight trunk. Here, logs with a 10-25 cm diameter is the most commercial product.

Central Mexico (Mexico City, Guadalajara, Monterrey). Nationally, there are three important centres for secondary processing and buying heavy lumber. The most important is

Mexico City, from where manufacturers and consumers from the central Mexican states are supplied. Guadalajara is second, which acts as a distributor for the Bajío, Western and Pacific regions. The third centre is Monterrey, which is the principal distributor in the North and Northeast of Mexico. The same medium and heavy species that are sold in regional markets are sold in these markets. Light-weight wood is sold mainly as plywood. An exception is **sacchacah** (*Dendropanax arboreus*), which is sold for pencil production.

Foreign markets. The *ejidos* of Quintana Roo that have a good forest management certificate have made various attempts to place their wood products in “green” European and American markets. These attempts were often supported by local companies interested in entering these markets or by overseas organizations interested in promoting forest management. The flooring factory PIQROO financed the certification of some *ejidos* and as well as its own production, but a short time later decided to expand its supplies to a large number of *ejidos*, certified or not, and stopped using the certification.

Ejido efforts did not go past the promotional stage for a long time. Only now is Noh Bec starting to export in a more systematic way. The main species exported have been **chaktekok** (*Sickin-*

BOX 24

Production of lesser-used medium and heavy sawn woods in Mexico

State	Estimated production Board feet /year
Campeche	5,000,000
Chiapas	1,500,000
Oaxaca	1,000,000
Quintana Roo	1,700,000
Other States	800,000
TOTAL	10,000,000

Source: Estimates of the Company *Productos Forestales del Sureste y Centroamérica, S.A.*

gia salvadorensis), because of its bright red colour, **catlox** (*Swartzia cubensis*), because of its almost black colour, and **chechen** (*Metopium brownei*), because of its decorative streak. These species compete in the exotic species market; i.e. those species which stand out because of their colour or interesting grain. These markets are more demanding than national markets and might be interested in buying dry wood.

There are various timber merchants who are exporting non-certified heavy timber to various places in the United States. In this case, the main species is **tzalam** (*Lysiloma bahamensis*).

Light-weight woods do not appear to have great potential in the exports market given that they have no streaks, design or character, and in general can be replaced with other species.

5.3.4 Markets for species from the RAAN

The purchase of wood products in the RAAN's regional markets is low. No city in the RAAN has more than 30,000 inhabitants. A low level of development depresses the market further. In Puerto Cabezas, the region's most important city, furniture and building needs are met by small business and a simple infrastructure, handling small quantities.

This means that most of the timber extracted is sold outside the region. Some goes abroad by ship as lumber (the Caribbean, United States, Spain, Korea). Many logs are transported by river

(Río Prinzapolka, Río Grande de Matagalpa) to the sea and once again upriver on the Río Escondido to Rama, where they are sawn or transported in log form to Managua. The third possibility is to transport logs or sawn lumber across land to Managua. The road infrastructure is bad; the main road which goes from the North Atlantic to Managua is no more than a dirt track in poor conditions, which converts the 500 km route into an odyssey of more than 20 hours.

Traditionally the logs have been transported in their natural state, but in the last few years the number of saw mills (especially mobile ones) has steadily increased. These saw mills are replacing the fixed saw mills in the centre of the country. There are no signs that the saw mills in the RAAN are improving their infrastructure; rather they are "opportunists" who set up with little capital and aim to work while they can, and close down the minute timber processing gets complicated.

Two large companies, that integrate extractions and primary processing, have started-up over the last ten years. These companies emerged with foreign capital to supply foreign markets. One is a plywood company and the other works in sawing activities, and is now integrating a flooring line.

In central Nicaragua, there is a greater industrial infrastructure than in the RAAN. However, the orientation and functioning of these firms also reflect the beginning stages of industrialization and trade: three enterprises exist which could be considered large (all produce plywood) and act

BOX 25

Consumption of lesser-used medium and heavy tropical sawn lumber in Mexico

Consumer Centre	Annual Volume Consumed [m ³]
Chetumal	700,000
Cancún	450,000
Guadalajara	2,500,000
Mérida	750,000
Mexico City	3,600,000
Monterrey	2,000,000
TOTAL	10,000,000

Source: Estimates of the company *Productos Forestales del Sureste y Centroamérica*.

BOX 26

Prices of lesser-used species

Product	RBM	Atlántida	Quintana Roo	RAAN
Standing timber	0.06 USD/Doyle Foot (approximately 10 - 13 USD/m ³)	This market does not exist	15 USD/m ³	12 - 24 USD per tree (8- 18 USD/m ³)
Sawnlogs on patio	This market does not exist	This market does not exist	49 USD/m ³	No data
Sawnlogs in primary processing plant	This market does not exist	This market does not exist	approx. 64 USD/m ³	80 -120 USD/m ³
Motor sawn or axe hewn lumber on the roadside (legal extractions)	0.40 USD/BF Timber sawn with chain saw with frame	A: 0.73 USD/BF B: 0.55 - 0.62 USD/BF C: 0.40- 0.48 USD/BF Timber sawn with chain saw without frame	0.44 USD/BF axe hewn (sleepers)	0.37 - 0.50 USD/BF Timber sawn with chain saw without frame (data from the Rio San Juan region)
Sawn lumber in saw mill	0.53 USD/BF	A: 0.97 USD/BF B: 0.69 USD/BF C: 0.40 - 0.57 USD/BF	D: 0.85 USD/BF E: 0.97 USD/BF	0.55 - 0.60 USD/BF
Sawn lumber for exportation	F: 0.70-0.80 USD/BF G: 1.5 USD/BF (fob Puerto Barrios)	No data	H: 1.32 USD/BF J: 4.50 USD/BF (free carrier)	K: 0.80 - 0.85 USD/BF L: 0.60 - 0.75 USD/BF (fob various ports)

A: Redondo (*Magnolia yoroconte*), san juan areno (*Ilex skutchii*), san juan real (*Vochysia hondurensis*), primavera (*Tabebuia donnell-smithii*).

B: Laurel (*Cordia alliodora*), marapolan (*Guarea grandifolia*), piojo (*Tapirira guianensis*), guanacaste (*Enterolobium cyclocarpum*), santa maria (*Calophyllum brasiliense*).

C: Barrenillo (*Ampelocera hottlei*), sangre (*Pterocarpus sp.*), rosita (*Hieronyma alchorneoides*), varillo (*Symphonia globulifera*), macuelizo (*Tabebuia rosea*), aguacatillo (*Ocotea caniculata*), hormigo (?), cedrillo (*Huertia cubensis*).

D: Light woods: amapola (*Pseudobombax ellipticum*), sacchacah (*Dendropanax arboreus*), chaca (*Bursera simaruba*).

E: Medium and heavy woods: tzalam (*Lysiloma bahamensis*), machiche (*Lonchocarpus castilloi*), chechen (*Metopium brownei*) (con albura).

F: Amapola (*Pseudobombax ellipticum*), santa maria (*Calophyllum brasiliense*), guaciban (*Pithecellobium arboreum*), danto (*Vatairea lundellii*).

G: Manchiche (*Lonchocarpus castilloi*).

H: Chechen (*Metopium brownei*) sin albura, machiche (*Lonchocarpus castilloi*), chaktekok (*Sickingia salvadorensis*).

J: Catalox (*Swartzia cubensis*) sin albura.

K: Luarel (*Cordia alliodora*), cortés (*Tabebuia guayacan*), pochote (*Bombacopsis quinatum*), cedro macho (*Carapa guianensis*), coyote (*Platimiscium sp.*), nogal (*Juglans olanchana*), roble (*Tabebuia rosea*).

L: Guayabón (*Terminalia amazonia*), guanacaste (*Enterolobium cyclocarpum*), guapinol (*Hymenaea courbaril*), genízaro (*Pithecellobium saman*).

Source: own data, survey CUPROFOR (1999) and SIFOR (2000).

like enclave firms. Another four firms are medium-sized, but a majority of firms are micro and small businesses, working with national markets.

For hardwoods, the Managua-Masaya-Granada corridor is especially important and, with some good-will, might be characterized as a “furniture production cluster”. Companies in this region have been working with hardwoods from the Pacific region for several years (e.g. **guanacaste, guapinol and pochote**). Supplies from the Pacific are becoming increasingly troublesome, to the extent that several saw mills which had previously concentrated their production on those supplies, have had to change products (starting to process pine) or are on the verge of closing down. For these companies, timber supplies from the Atlantic are not very promising due to the rise of sawmills in the RAAN. The serious buyers of sawn lumber (Spanish and Korean) are buying directly in the Atlantic region.

With this trend, it is not certain which direction the micro and small companies of the Managua - Granada corridor are going to go for their timber supplies. These enterprises have always obtained their supplies from timber cut with chain saws at

very low prices. The *motosierristas* who work in the RAAN, called *sampopos* in Nicaragua, cannot supply timber at the same price and have concentrated on extracting **mahogany**, which has led to problems with supplies for the micro and small industries in the corridor. Most probably sixty percent of these companies will disappear over the next fifteen years. The question is which woods will the remaining companies use (lesser used species, Pine, Imported hardwoods, MDF) and where will they obtain their supplies? Hopefully regional actors such as functionaries, business people, and traders, will start to shape positive answers to these questions.

5.4 Prices

While standing timber prices are similar in the four countries, sawn lumber prices differ significantly. It is important to note that prices quoted for sawn lumber in the Petén and RAAN were established by private enterprises, whilst prices in Quintana Roo correspond to *ejidal* companies. In the case of Honduras, prices for sawn lumber reflect the high prices of motor sawn lumber.

6 LIMITATIONS IN THE MARKETING OF THE LESSER-USED SPECIES

6.1 Basic limitations of lesser-used species

The lesser-used species in the regions studied have various limitations that reduce potential for market entry:

Small volumes: The majority of lesser-used species are available only in limited quantities, which often creates inconsistent and unpredictable supply. There have been several attempts to market these species in groups, but substantial differences between them create difficulties. It appears logical to concentrate marketing efforts on the two to three dozen species that account for 90% of available volumes.

Lower wood quality: With few exceptions, log quality of lesser-used species is poorer than mahogany. In general, logs have smaller diameters and lengths, the shape of the log is poorer, and some species have marked problems with regards to rot and insects. This in turn means the sawn wood has more defects. Some species have a high percentage of sapwood even in mature trees.

Reduced rates of recovery (see also Chapter 8.4): Lower wood quality leads to a higher percentage of waste and higher unit costs than more valuable commercial species, such as mahogany.

Examples:

- In the Peten, Gretzinger (1996) estimated rate of recovery using the difference between the volumes recorded during scouting (which records standing commercial volume) and log volumes in the log yard: it is 98% for **Mahogany** and **Cedar** and 93% for the rest of the combined types. Then he estimated the rate of recovery measured as the difference between the volume in the log yard and the volume bought and paid for the logs (after discounting for low quality wood). It was 90% for **Mahogany** and **Cedar** and 85% for the rest. The difference between these two data sets is probably greater in reality due to problems in measuring.⁸
- In Quintana Roo, one sees the same trend in lumber (Box 27). With the exception of **Amapola** (*Pseudobombax ellipticum*), lesser-used species have lower rates of recovery compared to mahogany. In addition, many species yield low quantities of higher grade wood, one reason being a high percentage of sapwood (e.g. in species like *Metopium*, *Swartzia*). Based on National Hardwood

⁸ The larger the diameter of the tree, the more the use of Doyle's volume equation underestimates the real volume of a log. Since mahogany trees in the study had larger diameters than the other species, the difference in the rate of recovery must have been larger than the nominal result.

BOX 27

Rates of recovery in sawn tropical species

Class	Equival to NHLA*	Mahogany	Sac Chacah	Amapola	Machiche	Chechen	Katalox
Mill Run, 6 ft. and longer	#1 common and better	41%	31%	46%	32%	22%	20%
Mill Run, 5 ft. and shorter	#3A common and better	8%	11%	7%	12%	6%	10%
Total		49%	42%	54%	44%	28%	30%
6 ft. and longer, rejects	#2B common and worse	6%					
5 ft. and shorter, rejects	#3A common and worse	3%					
Total		58%					

*) Grading rules used in Quintana Roo and by the NHLA are not directly compatible, therefore the cited equivalence is only an approximation. For machiche, chechen, and katalox differences in color (sapwood/heartwood) are not taken into consideration for estimating the equivalence of the NHLA classification. Normally, in the NHLA classification the variance in color strongly diminishes the grade of a board. (See also the following Box).

Empty cells: without data.

Source: Production records of the Noh Bec and Tres Garantias ejidos.

Lumber Association (NHLA) lumber grading rules, sapwood is classified as a defect and is classified in a lower grade. In addition, sapwood is difficult to market, which means that a smaller volume of wood bears the entire cost of production (Box 28).

Lower grade and recovery implies higher per unit processing costs. In the end, the lesser-used woods in the region under study lack the cost advantage that is a central issue for their substitution for Mahogany.

In Quintana Roo, the production cost of one board foot of a lesser-used heavy wood species is at least 50% higher than the production cost of sawn mahogany. In contrast, the market price for lesser-used wood is approximately 60% the price of mahogany.

Technical problems:

- Heavier woods require special tools (e.g. heavier machinery and cutting edges covered with stellite or tungsten). In a more modern production environment, this is not a major con-

cern; however, in the regions studied, this is a problem. Many of the species found in high volumes are also those with a high silica content, which further complicates processing.

- Lighter woods are generally sensitive to various fungi and insects and require special treatment and handling. The chemical treatments available locally (phenolchlorides) are prohibited in many countries and by Forest Stewardship Council certification standards, and alternative treatments have not been developed. As a result, it is very difficult to produce “certified” light weight woods.

6.2 Management capacity in community operations

Community forestry operations entail production and transformation of wood or non-wood products in rural communities. In some cases, a community forestry operation is identical to the government of a community (as is the case of many Mexican ejidos). In others, the operation is

an independent entity, separate from the community, and only includes persons with specific interest in the use of forestland (as seen in collective societies of Atlántida, Honduras).

A major limitation in marketing lesser-used species is the low managerial capacity in many community forestry operations. This is a sensitive topic because criticism of this aspect could be misunderstood as a critique of community operations as such, and hence, could be taken as a stance in favor and support of privatization of these operations. Although sensitive, this subject must be addressed because without changes in existing organizational structures, very few communities will be in a position to increase quantities and improve availability of lesser-used species for commercial purposes.

Community forestry operations differ from a private forestry business. For example, the purpose and the context in which they arise are different from those of a private business. The focus of a business is making a profit based on a financial investment, whereas, community forestry operations are generally established to regulate a community's access to a nearby forest. A major focus of regulation has been assuring equal access for all and the participation of as many community members as possible (usually men). This

has fostered a horizontal organizational structure in contrast to a hierarchical structure in a business enterprise. When ejidos were conceived, no one imagined that one day they would have to compete with large business consortiums in Brazil, Bolivia or Malaysia.

The active participation of community members in the decisions and benefits of forestry activities improves their ability to control use of community land and reduces conversion of forests. Unfortunately, the organizational structure that promotes high participation can create a variety of problems that have negative consequences for its ability to respond as a business (see Box 30).

In Figure 29, we can see that limited managerial capacity in community operations is frequently a consequence of diverse structural and cultural elements. These elements are difficult to change because they do not depend directly upon the volition of individual members within the community; nor are they directly addressed through training or technical assistance.

Can business ability be improved in community operations?

Over time it is possible to observe changes in the managerial ability of the community operations; however, these changes are not easy to describe.⁹ The majority of changes are temporal:

BOX 28		
Recovery rates: heartwood and sapwood		
Class	Machiche	Katalox
6 ft. and longer Heartwood	26%	12%
6 ft. and longer Sapwood	6%	8%
Total	32%	20%
5 ft. and shorter Heartwood	9%	6%
5 ft. and shorter Sapwood	2%	4%
Total	44%	30%
Wood graded as "heartwood" should contain less than one-third sapwood, worst case, for katalox and less than one-fifth sapwood, worst case, for machiche. Source: Production records of Tres Garantias and Caobas (two mexican ejidos).		

⁹ In part, this is due to the to the fact that until now, there has been a lack of indicators to measure the situation.

BOX 29

An order for railroad crossties

When Compañía de Ferrocarriles Mexicanos stopped buying railroad crossties from the region in 1998, the Sociedad de Ejidos from Western Quintana Roo sought new markets for heavy woods. A business from Northern Mexico ordered 760 railroad crossties, but set different measurements: the usual measurements of 7" x 8" x 8' were changed to 7.5" x 9" x 9.5" (an increase in size of 43%).

In spite of initial enthusiasm, only 72 were produced because the crossties were too heavy

to be carried on the back of one person, which is the traditional way to transport and extract the product (see title illustration). For reasons unknown, people from the ejidos did not cooperate to transport the crossties nor seek another solution. Since 72 pieces were too few for a truckload, they were sold at a discount in the regional market.

Lesson Learned: Even small, unspectacular changes in requirements can result in insurmountable supply obstacles because of reduced innovative capacity among community operations.

they occur when a leader is elected with a higher work ethic coupled with management capacity. This promotes increased capacity within the operation. When this leader ends his term and is replaced by a leader with reduced abilities, the management capacity of the enterprise falls again. In spite of this cycle, longer lasting changes do take place. These are linked to changes in the macroenvironment and organizational bases (i.e. formal education and culture), cooperation with external organizations and to definite changes in the organizational structure of the operations themselves.

There are several factors that support community business capacity improvement. Among the most outstanding:

1. *Socioeconomic level of the communities.* A generally higher socioeconomic level in the community as a whole facilitates the acceptance of a more efficient work system. This factor indirectly underscores the importance of formal education, among other things.
2. *Adequate external involvement.* Different technical assistance groups have begun to understand the importance of analyzing and improving the management abilities of com-

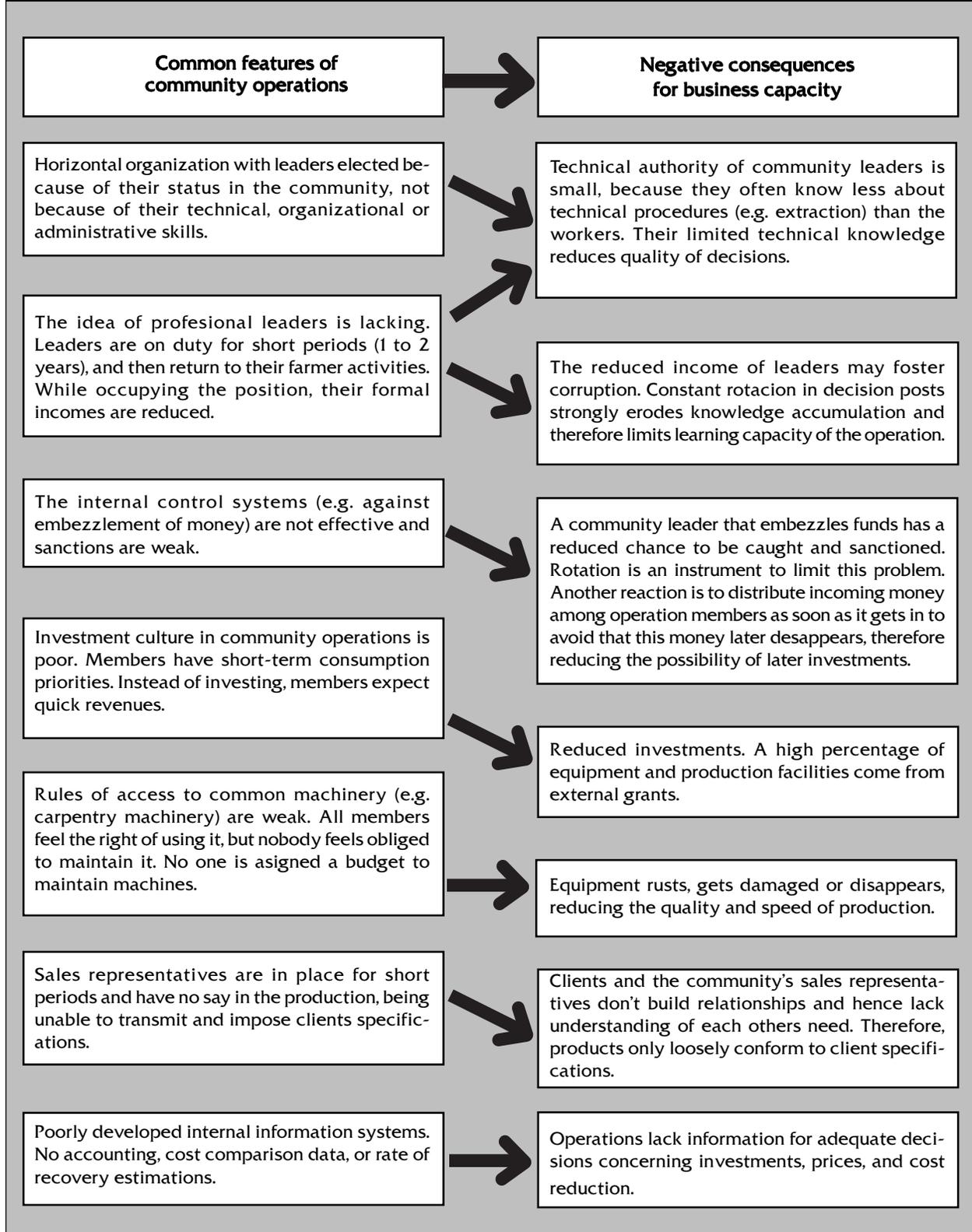
munity forestry operations, and of propelling them in this direction. For example, in Peten groups of forestry technicians have established a way to give input about the administration of forestry related tasks of community operations. This step, which has been criticized by institutions with a purist approach that think that communities should do everything, sparked basic improvements in the utilization systems of the regions.

Several other factors prevent structural and procedural changes in community forestry operations:

1. *Fear of social inequality.* A community gains its stability from homogeneous membership. Although richer and poorer families exist, the general tendency is to seek a leveling off. This implies that community leadership should benefit members in an egalitarian manner. From the community's point of view, everyone should have the chance to become a community leader at some time. This policy requires rotation of the key positions within the community; however it severely limits the accumulation of experience and knowledge.

BOX 30

Deficiencies in the business ability of community operations



2. *Rejection of the delegation of functions to outsiders.* As a community, the tendency is to be closed to outsiders, especially when it is ethnically homogenous. Communities tend to reject delegation of duties and functions to outside entities, even when this would clearly be more beneficial to the community. This is a major difference between the community operations of this region compared to various cooperatives in northern countries, where the concept that professional “outsiders” can occupy key functional positions prevails.
3. *Self-image and development concepts of external organizations.* Traditional community decision structures (typically the general assembly) are not efficient when doing business. External organizations have been slow in addressing this problem because it touches on deep rooted convictions of the technical personnel, such as “the more democracy and participation at the community level, the better”. However, there is evidence that too much participation is not in the best interest for communities, because it hinders effective decision-making. External organizations are also reluctant to promote changes in the community’s organizational structures because of a long history of failures and the belief that community development should be completely self-determined.

Various community operations have begun to seek new means of participation and decision-making structures, but results are slow to show. Basically, they have worked to separate the technical – administrative decisions (that can be made by “technical” leaders) from those decisions that have characteristics of community concern (and that continue to be made with the greatest participation possible). For the technical-administrative decisions they are promoting the professionalism of the technical leaders (who are not elected by the general assembly, but rather contracted; they receive better salaries, have more freedom to utilize funds, but are subject to much stricter finan-

cial control, etc.). A good example is the ejido of Noh Bec (see chapter 8.2.1).

Distinct differences exist between the various community operations, which also impact their business ability and in their potential to modify such capacity. These differences have been charted in Box 31.

6.3 Frictions between community operations and private businesses

The traditional systems of private concessions that brought riches to some madereros was altered with the beginning of community forestry. Although the appearance of this new system has brought about consolidation of forestry production over the long haul, it represents the end of businesses based on privileged access to the wood. Because of this, madereros, as well as business owners with vertically integrated operations, had problems accepting the newly imposed relationship. The new order excluded them from the profitable mahogany extraction and forced them to deal with community operations in a disadvantageous negotiating position.

On the other hand, community operations have not been interested in cooperating with regional players; specifically those communities that have been able to set up sawmills because they can sell their production outside the region. This fact greatly complicates the raw material supply of many secondary regional industries. Complicating this is the weak management of community operations and efforts of madereros to take advantage of this weakness (i.e. undermining the leaders).

Conflicts arising from these issues have not been completely resolved, and today a logical division of labor between community operations and private businesses does not yet exist. Both groups continue to try to vertically integrate in order to control new links in the production chain, and frequently end-up in businesses for which they lack the expertise to manage. The private businesses want to regain control over extraction, meanwhile community operations seek to control the extraction, primary and then secondary processing.

BOX 3 I

Differences between community forestry operations

Criteria	+ Range of variations in the characteristics of the operations -	
	facilitates business capacity ←	→ reduces business capacity
Forested areas	Large: i.e. some community concessions in Petén (> 60,000 hectares)	Small: i.e. some usage groups in the Atlántida (< than 1,000 ha)
Mahogany volume	Significant: i.e. Noh Bec (> 1500 m ³ usable / year)	Not significant (in the majority of the community operations)
Internal structure	Differentiated: a sanctioned business exists, Community and production functions are clearly separated (i.e. Unión Maya Itza or Noh Bec)	Not differentiated and not functional: no sanctioned business organization exists (i.e. indigenous communities in the RAAN)
Sameness of forest operation and community	The operation is independent from the community. Only a small percentage of the community members participate in the community operation (i.e. "Suchitecos", Petén)	The community leaders also manage the operation. High percentage of the community members are members of the community operation as well. (i.e. San Miguel community, Petén)
Operational functions	Only those functions directly related to forest usage	Diverse productive, community and political functions; dispute settlement
Reinvestment willingness	Medium: the members are in favor of reinvesting part of the surplus	Low: all the surplus is divided up among the members at the end of the season.
Internal division of labor	A division of labor with more or less clear hierarchies is established	Everyone does everything. When there is an order, operation leaders divide the volumes to produce among the members, and every member or group of members is responsible for a small volume in all production steps
Internal communication	Smooth and fluid: members are well informed regarding the existing orders	Poor: only some members, those in charge of sales, know the details regarding the orders
Work ethic	A culture of responsibility and learning is prevalent	A culture of minimal effort prevails
Attitude toward innovation	Members are open to trying new procedures and processes	It is difficult to implement new procedures
Number of members	There is a relationship between the number of members in the operation and it's business ability, but this relationship depends on many other factors. In general, a larger group can pool greater leadership, external aid and financing, but it runs higher risks with regards to communication and consensus building.	
Community infrastructure	Good: easy access to markets	Poor
Formal education	Moderate	Low
Stability of positions	Leaders are in the positions for prolonged periods of time	High rotation of positions

Source: Primary research.

The first point of disagreement is regarding extraction.

From the perspective of community operations, the sale of standing timber is unsatisfactory for various reasons.

- Profits from wood sales are greatly reduced
- For all practical purposes, no work is created for the community
- Opportunities to institute good silvicultural practices are reduced

Private industry does not have the least interest in giving up control of the extraction process. For them, this step is vital for several reasons:

- Direct control over the trees extracted
- Reduced financial expense, since the direct costs of extracting the trees themselves are considerably less than prepayments they would have to give to communities to buy logs decked and ready for transport

Communities have problems setting up extraction activities because of the high investment needed for extraction machinery (skidders, tractors, etc.). More economical means of extraction exist, but these are just beginning to be explored. On the other side, regional markets for logs frequently do not exist, and businesses that buy timber have their own extraction machinery and are not inclined to buy logs.

One way to avoid investing in extraction equipment is the use of chainsaws (with or without a guide, such as an Alaskan sawmill) or axes at the felling site to manufacture beams or boards. This requires low investment and in fact, is practiced by a large number of communities. This type of operation is dominant in Honduras and was dominant in the Mayan communities in Quintana Roo until a few years ago, when the demand for wooden railroad crossties bottomed out. It is also practiced in some communities in Guatemala.

This on-site production is attractive for many reasons, but in practice requires certain improvements and assistance to be viable. On many occasions, chainsawn or axe-hewn products are exposed to strong prejudices and misjudgements.¹⁰

The division of labor that develops following the implementation of community forestry depends on many factors. Large differences between community operations exist – in their internal organization, size and forest potential – all of which determine their ability to integrate certain parts of the transformation chain.

Some observations related to this topic, based on research performed for this study include:

- Well-organized community operations that have significant volumes of mahogany do not hesitate to buy extraction and sawing equipment.
- Forestry operations that have attractive volumes of mahogany, but also general organizational problems, do not tend to buy their own extraction and sawing equipment, but instead sell standing timber to private businesses.
- Community operations that are not attractive to private industry, because of lower volumes of commercial wood, or those community businesses that do not want to be limited just to sales of standing timber, but do not have the means to invest in heavy equipment, can begin to saw wood on location using axes, chainsaws or portable sawmills.

Over time, these factors combine to create a system in which well-organized and well-managed community operations achieve vertical integration and do not have problems selling high value wood; however, they may encounter problems in selling lesser-used species because of their lack of production and marketing abilities. On the other side, private businesses often try to establish relationships with poorly managed operations, which allows them greater control over felling and extraction.

¹⁰ E.g. Many technical advisors argue that the low recovery rate of these products is unacceptable, forgetting that the recovery rate is only one element for the profitability of a certain production.

Obviously, the different situations affect both sides. Community forestry operations with good forestry management are not able to sell lesser-used species. Meanwhile, businesses that have the capability to sell these species buy them without creating a positive effect on forestry management.

Building bridges between well managed community forest operations and regional processing companies with good marketing abilities will be a major task in the years to come. In reality, the most important conflicts within the commodity chains continue to be community relationships with private businesses. Often, it is at these points that the chain is broken. For example, when a buyer decides to stock up with imported wood. Conflicts arise in the trading of standing volume as well as in the trading of lumber. In both cases uncertainty about the possible actions of the other party is the first obstacle to overcome. In the event

that one party decides not to honor an agreement, it is difficult for either to implement due process to impose the legally established contract.

The problems existing in the trade of lumber are apparent for example in the Atlántida region. Here, only chainsawn lumber is traded. Even though the secondary industry is located near the sawing facility, organization of transportation and lack of communication create a great deal of uncertainty that has not been resolved. Groups that have managed to produce large enough quantities to merit renting a truck, frequently have not found a buyer - they go out in search of a client with the product loaded on a truck. Since the truck owner rents his truck by the mile and hour, the sellers are under pressure to sell the wood as quickly as possible and run greater risk of negotiating a poor deal. Once the product is unloaded, it is nearly impossible to reload.

BOX 32

Unnecessary losses in the Atlántida

Forest extraction in the Atlántida is affected by difficult technical conditions: some 60% of the forest land is located on slopes of more than 50% (Roper, 1995). In addition, there are practically no secondary roads, which is a strategy the institutions use in order to prevent the colonization and conversion of forest land. As a consequence, the timber is cut on site with chainsaws and later transported by mules to the villages. Several unsuccessful initiatives to use chain saws with a frame ("Alaskan saws") have been promoted. Without the frame, the resulting boards and beams are crooked. In addition, the sawn trunks have to be small enough to be carried out on mules. Depending on the timber type their volume ranges from 10 to 25 PT.

These two factors together lead to a poor-quality product. Buyers complain of high losses in the later transformation process. For example, 20% of the timber is lost just in the first cut in the resawing process.

Behind these costly inefficiencies, there are several problems:

- The current distribution system, which revolves around the madereros, seriously limits the communication between the forestry producers and the secondary businesses. This causes increased difficulty in reaching agreements about size and quality and would imply the need to develop a system to "beef up" the quality.
- Due to the style of work in the community operations, that is a vertical division of labor and delegation of certain functions, splitting up the proceeds requires a consensus that is difficult to reach; therefore, no one is willing to abandon the process and risk new approaches.
- Extraction techniques have not been improved.

These circumstances create a powerful negotiating edge for the buyer. He can impose strict quality standards and reject product. The only defense for sellers is their personal negotiating skills. In this scenario, one can see the problems connected with lack of grading standards, lack of formal agreements between the communities and secondary processing businesses, and lack of trust between the two groups.

In light of the large number of uncertainties, (the most glaring being the slowness of the AFE-COHDEFOR to expedite access permits) community groups cannot promise to deliver orders on a timely basis. This has negative effects on several levels. On the one hand, businesses are not inclined to prepay when they do not know if and when they will receive product in exchange. The businesses, unlike madereros, generally do not venture out into the communities to negotiate and hence do not have much control over what happens in the forest. For them, the system of advance payment carries too high a risk. On the other hand, not having a secure sale for the timber they produce, madereros seek a way to assure a sale and hence only work with species that have markets, such as **San Juan areno** (*Ilex tectonica*), **redondo** (*Magnolia yoroconte*), **marapolan** (*Guarea grandifolia*) and **barrenillo** (*Mortonodiedron anisophyllum*). This is a vicious cycle: some species are not offered because of uncertain sales and lack of buyers due to inconsistent supply.

The secondary industry has problems with liquidity and cannot always, nor does it want to, pay for wood when it arrives at their door. Pine suppliers offer easier payment terms, which is something the secondary processing industry hopes hardwood suppliers would adopt. However, community operations are not in a position to accept installment payments because collecting debts would require several trips from far removed communities. In addition, it would create disgruntled community members who want immediate payment for their labor. All of this generates tension and often brings into question the honesty of the community operations leader.

Also, for example in Quintana Roo, mechanisms for log sales are primitive. The buyer makes

a contract once a year with the ejido (which, except in the more organized ejidos, is verbal). To assure the purchase, the buyer must offer a prepayment that is usually 50% of the total sale. Since the rural sector has rudimentary administrative practices and rarely uses banking instruments, this prepayment is in the form of cash. This establishes a lose-lose cycle which benefits no one. For the buyer, it means the outlay of a great deal of capital and huge risk. For the seller, it means a situation that perpetrates a backward administration process and dependency on the buyer.

Buyers are, for the most part, old madereros. Many of them are on commission for wholesalers in Central Mexico, who are interested in the purchase of select species and who do not have interest in forming commercial alliances with sellers.

In summary, there are limitations on both sides that impede implementation of modern business practices that would benefit both parties. For industry it means unpredictable supply. Readily available lumber inventories do not exist, but rather are logs extracted and processed per order, which may take some months. During this time, the buyer's capital is tied-up. Liquidity problems within the forest products sector clearly limit the possibilities of marketing new species.

6.4 Shortcomings of private processing companies

Poor relationships between community operations and private businesses are not the only limitation in the production chain. Private business that represent subsequent links in the chains have problems too.

Normally, links along a production chain are mutually suited to each other. A highly developed business will buy its wood from producers that are also developed. An example can be seen in the comparison between pine and hardwood commodity chains. The pine chain is more competitive in nearly all phases of production and distribution. For example, standing timber volume per hectare is larger and more or less sound extraction regulations are in place. On the strength

of these two elements, competitive sawmills and a secondary industry without marked liquidity problems, have grown. In contrast, broadleaved forest production is still meager. Per hectare volumes are reduced and regulations are often difficult or impossible to follow, forcing many companies to work illegally. Lumber is distributed in a system plagued with liquidity problems and inefficient business practices. Buyers frequently belong to the informal sector (see Box 33).

Historically, the private businesses have grown (in the sixties and seventies) under easy conditions. Companies had access to very good timber supply and an absence of strong competition. This made it unnecessary to develop financial, technical and managerial capabilities.

Modernization of the countries studied, with continuous improvements in infrastructure and services, has greatly reduced transportation costs.

This has facilitated sales of the forestry products to external buyers, but also allowed the rise of commercial enterprises that offer new products in traditional regional markets. These dynamics have gained momentum with the commercial opening of markets between countries. The new competition for the regional industry shows the weaknesses of regional production chains.

These weaknesses are pivotal with regard to promoting new species and protecting already established markets built around lesser-used species. Regional businesses were not ready for the competition. Although private businesses do not have the structural organization problems that community operations have, their business capacity is below par. Management skills are poor and often lacking marketing knowledge. Companies are under-funded, and machinery is often obsolete. The horizontal and vertical links that are

BOX 33

Pine vs. hardwoods: two lumber businesses in San Pedro Sula, Honduras

Two lumberyards visited in San Pedro Sula clearly reflect the problems of regional processing chains:

- The lumberyard that sells pine occupies an area that is more than 5,000 sq. meters along one of the most heavily traveled streets of San Pedro Sula. It proudly displays various sawn lumber products in several dimensions, stacked and graded. For a small additional cost, the lumberyard will custom-cut boards. The manager is available to handle questions from clients and knows his business. He offers a delivery service. The manager gave up selling hardwood species some time ago due to the supply problems. He manages a volume in excess of 80,000 BF monthly.
- The lumberyard that sells the hardwood species occupies an area of 400 sq. meters, with approximately 15 meters of frontage on a sparsely traveled street in the same city. The motorsawn boards are stacked on top of each other just as they came out of the forest, twisted and cracked. One has to ask a neighboring merchant if the owner is in. After calling for five or so minutes to the other side of the road, the father of the owner appears. He knows the prices, but cannot give further information. The carpenters that purchase here have to take the boards that need resawing to another place. The quantities sold do not exceed 10,000 BF monthly. The business does not offer delivery service.

characteristic of successful regional production environments (clusters) are missing. An important element in furniture production is that companies have only marginally developed the capacity of combining diverse materials (wood with fabrics, metal or leather). This is a complex problem encompassing production, supply, logistics, and design (see below). Governmental and non-governmental industrial support is weak.

Results are predictable. In Quintana Roo, the secondary industry has practically disappeared. In the Petén, the two existing secondary processing businesses are operating at reduced levels. In the Atlántida, many secondary processing businesses are being displaced in their traditional markets:

- Export oriented companies (normally working with mahogany) are being displaced because Asian competitors are improving their quality and delivery times, and reducing required order size.
- In regional markets, new commercial enterprises are emerging and displacing products made in the region. Regional businesses have not reacted other than to reduce prices. Very few know how to differentiate their products.

Besides the previously discussed problems, design is an important issue facing exporting companies in the Atlántida. Furniture designs originate from US designers, who lack understanding of the characteristics of Honduran lesser-used species. As a result they cannot design around the strengths of the woods.

On the other hand, the type of furniture that is traditionally made in Honduras (department store furniture) is conservative and made for middle-class markets in the United States. This product line is not suitable for experimentation with color and texture, as would be, for example, Italian boutique furniture, which is designed for more modern tastes. Boutique furniture requires greater skills in combining various materials (e.g. metal – especially aluminum, synthetic finishes, and fabrics) than are available in Honduras.

6.5 Financing

Forestry production in the regions studied have clear problems with internal and external financing:

- **Community forestry operations were not designed to provide internal financing.** In contrast to a conventional business, where the arrangement for capital is a fundamental initial step, community operations usually have been established to regulate access and usage rights to the forests and other resources (agricultural lands, ranches). Their strength comes from the contribution of labor of the group members, not their contribution of capital. Along with this situation is the fact that the immediate objective is the distribution of work, and not profitability. Frequently, community operations lack adequate banking instruments to facilitate money management.
- **The attitude of members runs counter to the capitalization of the operation.** The attitude of community members toward funding a forestry operation is closely linked to the previous point. Several factors inhibit funding. In the first place, for many operations, the profits that were previously realized disappeared due to leadership errors or diversion of funds. As a result, immediate distribution of earnings without thought to the future capital needs of the business is preferred. Another factor is ineffectual investment in the operation. Frequently, there are errors in machinery purchases. There is also the attitude that the equipment is communal property which infers open access for all. The issue of maintenance and care of the equipment is also not part of the investment equation. As a result, pessimism about investing exists. Additional factors are the lack of a “savings” culture and immediate demands for cash among rural families. This leads to the use of the money earmarked for extraction process prepayments for personal needs instead.

BOX 34

Changes on Main Street: competition among furniture stores
in San Pedro Sula, Honduras

Traditional furniture stores in San Pedro Sula are situated along the main commercial street in the city. Shopping for furniture can be somewhat frustrating though, because they all offer practically the same products. The furniture is made in a style that was considered modern and elegant nearly 30 years ago (“the modernist elegance of the 70’s”: brilliant black varnished surfaces with gilded edges complete with glass tops). The wood is barely visible. The furniture varies between moderate- and low-quality with corresponding prices.

These furniture stores now have competition.

- In some of the best locations on the same street are the stores of two large international retail chains: *Elektra* (Mexican) and *La Curacao* (Dutch). These stores offer furniture made of alternative materials (metal, alloys) and are more affordable than traditional furniture stores. Designs are acceptable for the segment of the population with moderate to low income. These stores are open to buying regional products, but in practice this rarely happens, because of their buying conditions (low prices, long paying times, etc.)
- Furniture stores targeting the higher income segment have opened in the new commercial centers (malls) and on the “elegant streets” of the city. The furniture that they offer is impeccable in appearance and “elegant” in style. It combines natural wooden finishes, MDF, fabrics, aluminum and other materials. Although there is a store that

offers furniture made in the region, the majority of the stores offer imported products.

- In recent years, stores such as Price Club, which are oriented to the middle to upper-middle class segments, have opened. Many offer imported furniture. Furniture made in Southeast Asia using **rubber tree wood** (*Hevea brasiliensis*) predominates. An example is a small table with two benches, called a breakfast set. Although it is more expensive than the furniture in the traditional stores, it is efficiently engineered, obviously inspired by Ikea furniture (Sweden). Its design leaves behind the “modernist elegance of the 70’s” to express informality, functionality and “joy of life” with a green tint that enhances the natural grain of the wood.

The trend is clear. The stores that represent the end of regional production chains are losing market share to new competitors, who represent the end of various external production chains. This occurs in the low to medium income segment (main street), as well as in the medium-to high-income segment (malls and elegant streets). The newcomers profit from a more clearly defined target market, new designs, application of merchandising techniques, developed store image, and in general, a much better use of marketing tools. In general, the newer marketing mix is more developed and successful. Even with higher pricing, non-traditional stores are attracting a growing clientele from all economic levels.

- **Difficulties in obtaining credit.** In Mexico, and to a lesser degree in the other countries studied, commercial credit agencies have nearly no experience in granting credit to community entities. As a result, a large number of formal problems arise: the legal structure of the operation, its form of responsibility, and the procedures to establish guarantees. The ability of the banks to analyze the credibility of a project for financing is limited, even though communities assure the credit with strong guarantees. In general, the granting of credit for operations in the forestry sector is not a priority for commercial banks. As a rule, banks do not normally have sufficient knowledge about the forestry sector to allow them to establish a sound line of financing, nor do they have flexibility with regards to procedures and time frames that would permit implementation of these lines of credit. Development banks and governmental financing function outside normal banking policies and directives, and often grant credit without adequate guarantees. Their focus is political rather than financial objectives. Non-forestry sectors continue to have priority over the forestry sectors.
- **Focus on tangibles.** The institutions and people that make decisions regarding the granting of economic support, such as credit

or grants, tend to finance equipment and machinery, frequently with the goal of vertical integration. At one extreme, they finance the purchase of expensive machinery but do not include funding for the expertise of someone who knows what to buy. Hence, the money frequently is spent on machinery that does not serve the purpose for which it was purchased. One example of this is the financing of portable sawmills. In Peten and Quintana Roo, of the eight portable sawmills bought with external funds over the last ten years, five never passed the test phase because they were not suitable for sawing the species found in the regions. In two instances, the saws were completely ill conceived and would not have worked even with softwoods. Banks and donors are partial to financing machinery and equipment because it is easy to confirm appropriate use of funds (i.e. by means of a receipt and existence of the machinery), and because they often do not know that other alternatives exist for optimizing production (e.g. reducing costs, improving productivity, etc.) It should be stated that these types of alternatives are often linked to systematic and efficient loan processes, and the type of technical assistance that is just beginning to take shape in the regions under study.

7 MARKETING OPPORTUNITIES FOR LESSER-USED SPECIES

7.1 Certification

The certification of forestry operations by third parties in accordance with Forest Stewardship Council (FSC) standards has created significant opportunities to increase sales of wood coming from “certified” forests. Forestry operations in the regions studied understood early on the opportunities that certification can offer. They were among the first in the world to be “certified” and currently, there are a significant number of certified operations in these regions.

When the idea of certification began, the first “green” businessmen from the United States and Europe that arrived in Mexico and Central America came to buy wood that not only came from the well-managed forestry operations, but they also strongly preferred wood from community forestry operations. In general, they rejected the idea of buying wood through a private local intermediary.

The growth of commercial quantities of certified wood was slow. For a long time, forestry operations did not produce the quality needed nor within the time-lines required. The resulting order backlogs meant lost sales and reputations of U.S. and European buyers. In addition, prices were high (cost accounting to support higher prices did not exist and there was a mistaken belief that foreign buyers could afford to pay more).

This required the “green traders” to work within small niche markets. In addition, markets for certified wood proved to be more difficult to create than expected and market segments in which certification was important were much smaller than expected. Frequently, the sale of certified wood was a form of advertising that allowed better market access for the non-certified products of a business. In spite of these limitations, the impact of certification on forestry management in Mesoamerica has been positive.

In the commercial arena, the most important aspect of certification has been the learning opportunity. “Green” traders were much more tolerant of deficiencies in the community operations than traditional buyers. The efforts of people like Mark Platin (Wild Woods/United States), Hubert Kwisthout (Ecological Trading Company/Great Britain) and Jürgen Jordan (Espan/Germany) have provided community operations a chance to learn about production and export sales.

The business of certified woods in “green” markets will certainly grow over the coming years. The more developed community operations are in a position to respond efficiently to export orders. Nevertheless, it is naive to think that “green” markets will be the principle outlet for the lesser-known woods found in the regions studied. Over the next ten years, conventional markets will continue to be the primary destination for these

woods. This conclusion, although preliminary, is based upon the following considerations:

- Only a minority of community operations will develop sufficient management capacity to be able to compete in international markets.
- Prices of sawn wood made from lesser-known species are too high to allow penetration of larger markets
- Certified private forestry operations of Bolivia and Brasil have strong advantages (e.g. much larger concessions, total control over extraction, and virgin forests), and do not appear to have as many problems producing sufficient certified products to satisfy market demand.

7.2 Lesser-used species and promising markets

7.2.1 Petén

At present, the geographic isolation of the Petén, the easy availability of wood suitable for furniture production in Central Guatemala coming from other regions, and the growing importance of wood from plantations all greatly limit the potential for marketing lesser-used light-weight species from the Petén. However, heavier woods have good market potential. Some that stand-out are:

- **Pucté** (*Bucida buceras*): This wood is quite similar to **chichipate** (*Sweetia panamensis*). At first glance it is difficult to understand why these two types cannot be marketed together. The reason is primarily differences in physical/mechanical characteristics and inferior workability of **pucté**—the boards have a tendency to bend and warp, sawing and sanding are more difficult than chichipate, and the dimensional changes which occur after cutting and drying are greater. Nevertheless, none of these factors are insurmountable technical challenges.
- **Ramón** (*Brosimum spp.*) – Species in this group have significant potential as flooring. The main technical problem is high sensitiv-

ity to sapwood stain. Without adequate management, it is nearly impossible to produce stain-free boards. Toledo (1996) also reports drying problems. An added problem facing greater use of this species is that it could generate concern among environmental groups since it offers high nutritive value to the wildlife.

- **Chicozapote** (*Manilkara zapota*): This species is highly attractive because of its dark purple color. It also has superior lateral hardness, making it ideal for flooring and can be used in heavy construction for ground contact application and in wet areas. Cutting of green trees of this species is currently illegal because of its importance for the extraction of chicle (dead or down can be removed though). Unlike Mexico, forestry extraction and chicle production in the Petén are accomplished by two different groups. This makes it difficult to introduce its use as a wood source since “chicle” groups tend to block any attempts to open this avenue. However, in general terms, it can be demonstrated that the region’s potential chicle production by far exceeds actual demand. This situation will become increasingly true since the demand for natural chicle is diminishing with time.

Interesting markets for chicozapote are:

- **Flooring production in Guatemala City and the Oriente (eastern Guatemala, in the area of Zacapa and El Ranchito).** Buyers in these two markets differ greatly: the businesses in the Oriente are geared towards export and are much more conservative in integrating new species of wood in their product lines. A new species must be available in significant volumes (a monthly minimum of 30,000 BF of sawn wood) and be esthetically attractive. These businesses have expressed an interest in **ramón**, but could also be interested in the **malerios** (*Aspidosperma sp.*), in **luin hembra** (*Ampelocera hottlei*) and in **pucté** (*Bucida buceras*). Flooring businesses in Guatemala City are

fewer and are geared toward local markets. They are open to new species, but it is foreseeable that their demand will be much less and more intermittent than that of Oriente businesses. The product that these businesses require can be made more easily and with fewer problems by workshops in the Petén, and thereby establish a value-added step in the process. Besides the species mentioned above, businesses in Guatemala City could be interested in **tzalam** (*Lysiloma bahamensis*), **manchiche** (*Lonchocarpus castilloi*), and **danto** (*Vatairea lundellii*), because of different preferences of final consumers.

- *Local markets and inexpensive furniture.* In light of fewer possibilities for marketing sawn wood of the light-weight varieties outside the region, the most likely outlet will be in the manufacture of inexpensive furniture for growing regional markets. There are several private wood working shops, as well as community ones, that could focus on this market.
- *“Green” markets for the heavy exotic woods.* The “green” buyers have shown interest in **manchiche** (*Lonchocarpus castilloi*), **chechen** (*Metopium brownei*), **jobillo** (*Astronium graveolens*), **llorasangre** (*Swartzia cubensis*) and others. It will be important to cement relationships with the buyers by working with enterprises that already have capacity to supply these species efficiently and are able to increase their commercial volumes. A second phase would be the introduction of new species.
- *Flooring markets and markets for exotic Mexican woods.* Mexican markets will become of interest to the Petén with the probable construction of a direct highway between the Petén and Mexico in the near future. Several species are used to make flooring in Mexico, including **tzalam** (*Lysiloma bahamensis*), **chechen** (*Metopium brownei*), **manchiche** (*Lonchocarpus castilloi*), and possibly **ramón** (*Brosimum sp.*) and **pucté** (*Bucida buceras*).
- *Various markets for decorative veneers.*

7.2.2 Atlántida

Many interesting species are found in the Atlántida, the majority of which are suitable for furniture and some for flooring:

- **Huesito** (*Macrohasseltia macroterantha*)
- **San Juan Colorado** (*Vochysia ferruginea*)
- **Rosita** (*Hieronyma alchorneoides*)
- **San Juan Peludo** (*Vochysia guatemalensis*)
- **Cedrillo** (*Hurtea cubensis*)
- **Barba de jolote** (*Cojoba arborea*)

None of these species pose major processing problems.

The most interesting markets are:

- Regional production of furniture
- Regional production of flooring (see Chapter 8.1.3).

7.2.3 Quintana Roo

Supply from plantations in Mexico will be of secondary importance over the next ten or more years due to the small area planted. This implies stable possibilities for high-quality light-weight wood classes, such as **sacchacah** (*Dendropanax arboreus*), **chacah** (*Bursera simarouba*), and to a lesser degree **negrito** (*Simarouba glauca*) and **jobo** (*Spondias mombin*).

As for heavier woods, **tzalam** (*Lysiloma bahamensis*) and **manchiche** (*Lonchocarpus castilloi*) will see increasing sales. The same could be possible for **chechen** (*Metopium brownei*), although sapwood utilization is a problem. Another promising species is **katalox** (*Swartzia cubensis*), although the problem of sapwood utilization is even greater than in chechen. Because of their specific characteristics, **Katalox** and **chaktekok** (*Sickingia salvadorensis*) will probably not achieve the sales volumes of species previously mentioned, but could occupy some interesting niches for exotic woods.

Some interesting markets are:

- *Flooring production in Quintana Roo.* This market is not being accessed by the ejidos due to financing problems. The wood provided by local suppliers to the local flooring manufacturer comes from operations with poor forestry practices, but the advantage is a 30-day payment period (see Chapter 8.1.3).
- *Marketing of wood in Mexico City* (heavy species). The Mexico City market currently has more demand than the region can supply, even though the region's forests have the potential to satisfy the demand. The primary problem is the financial capacity of the intermediaries involved, who can only handle limited quantities at a time. Another problem is the coordination between sawmills and operations that do not have sawing capability.
- *Marketing axe-hewn/motor sawn heavy woods in the United States.* Little knowledge exists about the hand- or rough-hewn market in the U.S. The architectural accent niche market, such as interior and exterior, non-load bearing beams, fireplace mantles, and exterior appearance posts, should be considered.

7.2.4 RAAN

The RAAN has a different level of regional development than the other regions studied. The Petén, Atlántida, and Quintana Roo have identifiable community forestry practices that have a clear impact on forestry use in a minimally accepted legal framework. On the other hand, the RAAN is still a frontier region that lacks identifiable forestry practices and there is practically no constructive state level process regarding land use. The result is insecurity regarding ownership of the land, uncontrolled immigration, exploitive forestry practices, and a divestiture of the indigenous communities with regards to both their lands and traditional practices. In this context, priorities should be the establishment of a forestry system, and

not the promotion of the marketing of the wood. In the opinion of the authors, a constructive relationship between forestry production and markets will not be seen within the next five years.

7.3 *New forms of cooperation between forestry operations and private business in the Petén*

In 1997, a concession for a forestry community was approved in the Petén for the "Sociedad Civil Impulsores Suchitecos". This group is made up of ornamental palm leaf collectors, former workers for forest companies, and small-scale wood extractors (motosierristas). The majority of them live outside the reserve in Melchor de Mencos, which is a small city on the way to the border with Belize. Since its inception, this group has demonstrated high management capacity. One can also add knowledge of felling and extraction practices, marketing, and the mentality of forestry workers. That is to say, faith in the profitability of forestry activities. A problem for this group is the great distance from their concession to the main highway (over 40 km). The group is also interested in adding value to their product. When they began, they did not have money to buy the equipment to make roads and skid trails, much less for sawing the wood. On the other hand, a business in Flores, managed by Don Eugenio Tajer, was fighting supply problems. With the participation of the "Co-responsible NGO" (Fundación Naturaleza para la Vida), the technical group that aided the community operation, an agreement was reached wherein expenses and incomes of the joint activities were divided, including felling, extraction, transportation and sawing all the way to plywood manufacturing. Several additional negotiations decided who would do what work, who would finance the work, who would market, etc.

The final agreement negotiated allowed members of the Suchitecos group to do the majority of the work – extraction to sawing – with pre-financing from both parts (the group prefinanced labor costs, the company other expenses). They also marketed their product. Because the production

BOX 35

Opportunities for the use of smaller diameter species

The state of Quintana Roo receives between 800 to 1500 mm of rainfall per year, which in combination with the relatively poor calcareous ground yields a semideciduous tropical forest with a canopy of between 8 m and 18 m. Many wood species do not reach minimum cutting diameters required for lesser-used species (35 cm DBH). For example, **zapotillo** (*Sideroxylon gaumeri*) represents some 18.8% of the total number of inventoried trees in the forest, but it is only 9.3% of the basal area and 7.6% of total volume. It is rare to see diameters greater than 35 cm. Many other species have similar diameters. Until now, harvest has been concentrated on trees with a diameter in excess of the minimum allowed for cutting. This limits the potential for the development of a forest industry and does not take advantage of existing volumes.

At present, smaller diameter trees are mainly used for the type of rustic construction found in tourist centers - which is supplied mainly with contraband wood. Over the last few years, certified forestry operations have recognized this potential market and begun to develop guidelines for orderly use of smaller diameter trees, including those that get larger, but for which smaller diameters are in demand, for example, **chakteviga** (*Caesalpinia platiloba*).

The use of smaller diameter trees can be developed through various scenarios, each of which has implications for forestry and organizational issues, and markets:

- Use of trees felled for road and skid trail construction: In most cases, only those trees specifically felled for extraction are utilized. Ejidos that have started utilizing smaller diameter trees removed for skid trails and roads have not only gained supplemental income, but realized significant savings in the extraction costs for larger pieces. This is due in part to the fact that a skidder does not have to push over the small trees,

thereby saving time and fuel. The market for the posts in tourist centers is sufficient at this time to absorb production resulting from this method.

- Greater use of smaller diameter trees within a designated cutting area: There has been an increase in extracting smaller diameter trees with special characteristics that already have established markets (i.e. straightness for posts). Increased removal of smaller diameter trees could potentially encourage growth of higher value species. Available volume from this treatment method will be much higher than the volume from roads and skid trails. It is estimated that current stock probably exceeds three million cubic meters.*
- Use of smaller diameter trees from currently non-productive forests: There is potential to utilize trees from forests growing in unused agricultural areas ("acahuales"). There is no information regarding growing stock or growth, nor have utilization strategies been developed. However, the mere size of the area in question (more than three million hectares) implies significant potential volume.

The market for posts is too small and selective to take advantage of the latter two alternatives at this time. However, there is potential to use smaller diameter trees as a source of energy for various regional businesses that have high energy demands, such as sugar and cement factories. These businesses could use wood as a substitute for non-renewable sources of energy, such as oil and gas.

In summary, the potential to use smaller diameter trees is promising. It could greatly increase wood utilization and generate employment. In order to function, this option requires feasibility studies in the areas of marketing, forest potential, and organizational aspects. Following these studies, a testing program and follow-up extension phase would be necessary.

* Estimate is based on 500,000 hectares with growing stock of 6 m³/ha.

of the wood was completely prefinanced, it allowed complete independence from the buyers.

- (a) *Implementation of Grading Practices:* In the first year, mahogany (**mahogany** (*Swietenia macrophylla*) and **manchiche** (*Lonchocarpus castilloi*) were produced. From the beginning, the Suchitecos managed to achieve something that the Mexican ejidos had not been able to in 15 years: use of grading practices accepted in the United States. Something even more surprising is in the subsequent year, they were able to refine the grading, obtaining a greater percentage of higher grade wood and substantially improving the final results. These points are indicative of their learning capacity and potential for innovation.
- (b) *International Marketing:* The Suchiteco group sought foreign buyers to improve the price of mahogany (**mahogany**) and to sell **manchiche** (*Lonchocarpus castilloi*). Buyers appeared from Mexico, the United States and Germany. The sawn wood could be inspected by interested parties and transported as soon as it was paid for, in a process that was exceptionally straightforward for customers. Larger volumes were sold in the U.S. some three months after production. In this case, “green certification” did not play a major role. Traditional wholesalers were in a position to pay equal or better prices for the mahogany than buyers in green markets. The **manchiche** (*Lonchocarpus castilloi*) was sold to “green” buyers in Germany.

An important point to stress in order to understand the dynamics behind the development of this operation was the work ethic, business skills and abilities of the NGO that shared responsibility for the operation. The joint work of the Suchiteco group and NGO demonstrates how well the triangle of community operations – technical organizations and normative institutions (in this case CONAP) can function. This cooperation is perhaps the

most interesting of all the “production chains” in the Petén. It builds on the strengths of both the community group and private business, and the agreement between the community and business that divided jobs and costs fostered an analysis of costs by both sides, and eventually yielded a mutual concern to reduce them. If this agreement further satisfies the private business owner, it will become an example with potential to help increase the use of lesser-known species.

The agreement between the Suchitecos group and private business has other advantages:

- It combines the ability to control use of the land (e.g. reduce conversion) of community operations with marketing experience of the private company.
- The agreement reached between the business and the community operations promotes the introduction of costing systems to forestry operations. This is a basic prerequisite for improving income from lesser-used species.
- Another important aspect of this agreement is that in taking the production to “neutral” ground (away from negative community influence), it is able to overcome community organizational problems and makes it easier to adopt technical knowledge.

Changes are occurring in the original agreement. The Suchitecos operation has bought its own equipment and is now in a position to produce independently. However, other operations with fewer organizational and investment possibilities have entered the arena. These groups have smaller volumes of mahogany that are dispersed across their concessions– which makes extraction more difficult and less profitable.

Further progress for this type of cooperative agreement will depend to a large degree on how communities negotiate with the private company. If communities unite and act as a “cartel”, chances are that positive aspects like the cost-consciousness and the flexibility of agreements as well as the profitability may be lost.

8 EXPERIENCES INTRODUCING LESSER-USED SPECIES INTO MARKETS

8.1 Promotion of new species

8.1.1 Wood promotional centers

Promotion of “lesser-known” species began with proper identification of wood imported into Europe and the United States (see Hess and Record, 1950) and later description in various wood laboratories in these countries (aesthetic and physical-mechanical properties, and later their machinability). By the end of the 70’s, laboratories for the study of wood were present in Mexico and Central America. These laboratories completed important work in the description of the lesser-used species. In Nicaragua, the Laboratorio de Tecnología de la Madera, with help from the Swedish government, described more than 70 species between 1990 and 1994. In México, at least four laboratories have worked with tropical species. In Honduras, the Centro de Utilización y Promoción de Productos Forestales (CUPROFOR) is currently working on the description of Honduran species. The only country that does not have this type of facility is Guatemala.

It is obvious that the work of the wood promotion centers is fundamental to begin to systematically introduce new species to markets. Nevertheless, the wood laboratories have had serious problems in maintaining their activities over prolonged pe-

riods. They differ from the laboratories in U.S. and European countries, which work with species from all over the world and are also utilized to test new wood products. The laboratories in Mexico and Central America commonly have lapses in activity as soon as the more important species from their countries have been studied and external donor support withdrawn.

On the other hand, it is clear that although the work of the wood laboratories is basic for the promotion of lesser-used species, by itself it is not enough.

The response has been to enlarge the scope of work of the laboratories to convert them into wood “promotion centers”. Basically, they seek to reduce the cost of experimentation and risk for businesses through practical experimentation with new species (e.g. production trials, development of drying schedules, and development of adequate designs for products made of new species). The two institutions that have followed this path are the Centro de Capacitación y Diseño Industrial (Mexico) and, much more ambitiously, CUPROFOR in Honduras (see Box 36). A common danger for the wood promotion centers though, is the “cocooning”, a lack of a real working relationships with regional wood products manufacturers. The centers appear to find it easier to work with the sophisticated machinery they own. They do not take into consideration the technical limita-

BOX 36

CUPROFOR: Experiences of a wood utilization and promotion center

The Centro de Utilización y Promoción de Productos Forestales (CUPROFOR) is the tropical woods research center for the Administración Forestal Estatal - Corporación Hondureña de Desarrollo Forestal (AFE-COHDEFOR). CUPROFOR is the result of a cooperative project between Honduras and the United Kingdom, in which both countries have channeled substantial investments.

CUPROFOR's objectives are to promote use of lesser-used species to reduce over-exploitation of more valuable species; contribute to sustainable production of the forests, and improve quality of life for the people that depend on the forestry-wood products sector. The Center has an impressive infrastructure, including a laboratory for technical and chemical analysis, a well-equipped wood working shop, large sawing facility, three dry kilns, open air drying shed, showroom, library with large collection, conference room, administrative buildings, dining hall, etc.

CUPROFOR is well-known in the forestry-wood products sector and enjoys a good reputation. The Center has published several technical bulletins regarding lesser-used species and has a knack for presenting information in layman's language so it is easy to understand for small to medium-size businesses.

The Center also offers services, such as resawing, drying, and saw sharpening as well as courses, such as wood stacking and drying.

Some areas could be improved to better achieve Center objectives. For example:

- Target groups: The Center has not adequately assessed and described its possible target groups, and has not defined the potential of each, nor how it plans to work with them. At the same time, the "one size fits all" approach is not adapted to the specific requirements of each business or group of businesses. In addition, some of the services offered compete with private industry in an unfair way, since they only consider direct

costs (i.e. re-sawing, drying, and saw sharpening). A solution would be to differentiate prices for these services according to the size of business. This way services could be offered to businesses that otherwise would not have access to them, without being in direct competition with the other providers of these services.

- Furniture Design and Production Classes: The woodworking shop holds courses on woodworking and furniture making. The furniture is copies of furniture found in magazines and is technically high-quality. The furniture is made without haste, using traditional carpentry joints, in the same manner as an ambitious amateur would work. However, these procedures and designs do not touch on any problems that regional wood working shops are experiencing. These shops have to make products in less and less time and at reduced costs for specific distribution channels. Only in very few cases do they work with designs from the Center's woodworking shop because these designs don't fulfill customer preferences. The Center's wood working shop could have greater impact if it instituted more systematic procedures for development of designs, selected the business groups it works with more carefully, and defined target markets and channels of distribution. With this strategy, it would be possible to promote designs that facilitate strategies for product differentiation while reducing production costs for regional processing companies.

The consequence of a lack of a clear benefit for various business groups is that CUPROFOR receives little cash from the private business sector. The experiences of wood promotion centers in Nicaragua and in Quintana Roo (CECADI), which nearly collapsed after withdrawal of external support, are examples of what should be avoided.

tions and specific market orientation of regional carpentry shops. The result are products (mostly furniture) that regional businesses have difficulty incorporating into their product lines.

It is important to note that other institutions, with much smaller amounts of money, have similar objectives in promoting artisan handcrafts. One example is the Mexican organization AMACUP (Asociación Mexicana de Artes y Culturas Populares). In this case, technicians work in the shop of the person receiving assistance. The products they develop in this setting offer real possibilities for the artisans and real life problems are dealt with. Emphasis is placed on the design and marketing of these products.

8.1.2 Commercial promotion projects

Given the problems of marketing sawn wood from lesser-used species, the first activity of technical assistance groups that aided community operations (Guatemala, Honduras and México) was to look for new markets for existing forest products.

The market research studies conducted in Mexico and Guatemala yielded similar results: there was demand for different species. The problem was lack of ability to offer the wood at a price and quality required to be competitive. Results highlight a central weakness of the community operations: The lack of flexibility and ability to adapt to buyer demands. The positive news from these studies was that businesses exist in other parts of these countries that are able to make a profit with lesser-used species.

Other types of commercial promotion projects for lesser-used species exist that are integrated with the larger national industry. These types of projects are not happening in the regions studied but it is worthwhile to comment about them. These projects consist of several phases:

- Determine forestry potential
- Evaluate existing use of the species
- Address knowledge gaps about physical - mechanical characteristics

- Conduct manufacturing and marketing trials with interested businesses
- Create investment programs
- Find commercial contacts in relevant markets

This process has proven successful in various countries, for example, Peru,¹¹ that base their forestry system on large industrial concessions. However, this approach presupposes adequate business capabilities along all links of the production and distribution chain. That is to say, at no time are deficiencies in the legal framework, extraction, processing, or community operations questioned. Neither are those in the relationship with the processing businesses. Basically, this process is an option for big businesses with control of the entire production chain, from access to export. This process is also an option for production chains where all the links have sufficient business capacity and major conflicts among them are non-existent.

8.1.3 Private businesses

Nearly all the businesses in the region have tried to market lesser-used species at some time. Promotion has generally taken the form of making and distributing samples, but there have also been more original attempts, such as the sale of **tzalam** (*Lysiloma bahamensis*) under the name of **caribbean walnut**. Other businesses have attempted to modify consumer attitudes by means of television commercials that show off the beauty of these little-used woods. Without a doubt, the larger floorings businesses have been the most successful in market introduction of the lesser-used species. Some factors behind these successes are:

- World demand for wood flooring has grown rapidly over the last 15 years, which has encouraged introduction of new woods.
- Businesses have made major efforts to define channels of distribution to support the sale of products.
- Several heavier lesser-used species are ideal for this use.

¹¹ See Toledo and Rincón (1996).

- Businesses have emphasized wood supply. Instead of one buying department, these businesses normally have a buying group (e.g. forestry representative, wood workers, and trusted community representatives) in charge of delivering the wood. Between this and acceptance of higher finance costs, they have been able to adapt to the community forestry production structure and resolve supply problems.
- Recruitment of good managers with technical and negotiation skills, and marketing abilities. This point, that should be obvious, is quite difficult to achieve in the study regions and has been a critical element in the success or failure of countless businesses.

With these factors in place, it is possible to reduce harvest and processing costs to acceptable levels, and the consumer has responded positively to the introduction of some new species into the marketplace. From a forest management standpoint, a problem arises that, in order to reduce costs, some businesses prefer to work with communities that have a weak organization and low forest management capabilities, which in turn, implies lower standards of forestry management (see the text on "PIQRO" p. 106 and the almost traditional chain in Guatemala).

An important group in the promotion of lesser known species is the "green" merchants who, five to ten years ago, began seeking markets for species that traditional wood merchants in Europe and the United States had tried and rejected some time before. Because the "green" buyers paid good prices to the communities, the communities began to pay attention to these specialty niche markets. In the United States, this is the exotic woods market (species that because of their streaks or color are destined for special uses). In Germany and Great Britain, the main market was musical instruments. The small volumes available were not considered major problems because these markets did not require large volumes. The businessmen estimated they needed to start with between 60,000 and 120,000 BF per year.

Volume and quality of supply from community operations turned out to be problems. There

were shipments that were defective, badly cut, poorly stacked, and mis-sorted. In addition, there were problems of several months of back orders, charges for wood that had been prepaid but subsequently sold to another buyer only days before shipment was to take place, and no replacement volume provided when mistakes happened. The first generation of "green" merchants disappeared after a few years due to supply problems, not lack of markets.

The following describes three private business-marketing experiences with lesser-used species.

ATLANTIC WOODS (ATLÁNTIDA): A LOST OPPORTUNITY

Atlantic Woods is a truck bed producer. They bought special machinery to manufacture this product, therefore becoming the first company in the region to abandon the use of general purpose carpentry machines. The business invested a significant amount in product development and in market selection.

Production began in 1997 and peaked in 1998. During this time, the business employed up to 130 workers and produced from two to three containers per month (the customer wanted four or more). Wood consumption was approximately 75,000 BF per month, mostly species that were too heavy for furniture production and for which no market existed. As a consequence, it gave a real boost to the forestry production in the collective societies.

Production was achieved despite the external regional context. The business had to constantly fight problems that do not exist in other countries and that usurped 50% of the manager's time, such as the inability to obtain a steady supply of electricity.

Wood supply was also a significant problem, not just its consistency and pricing, but also the quality. For example, suppliers produced the lumber by chainsaw without guides. The result was that much of it was uneven and crooked. Transport of the lumber by mule makes it necessary to reduce the dimensions of the lumber (see also chapters 3 and 4.5). Both elements resulted in a waste of more than 20% on the first cut to

straighten the block face. Atlantic Woods also never came to agreement about standard dimensions with suppliers (i.e. communities and intermediaries) which caused additional losses further down the line. The quality of wood also left so much to be desired that costly checks, block by block, had to be conducted upon receipt of the wood. In general, suppliers were unable to improve the quality of their product, even in basic aspects. Finally, AFE-COHDEFOR never provided support in the form of technical assistance or training.

The benefits generated by Atlantic Woods, such as employment and forestry production, should have merited substantial support from the governmental agencies. On the contrary, the business had to deal with tedious bureaucratic procedures, and was even criticized from unexpected sources. For example, in one study for CUPROFOR, Ardón *et al.* (1997) write: "...it seems a shame to see how such good woods like **rosita** and **varillo** are exported as low value-added products [truck beds], when they could be going as fine furniture... On the part of the local producers there is a concern that this company is going to push the prices of these woods upward". Therefore "...the work of the business should be reviewed since its functioning can have a negative impact on the national industry."

This argument merits an analysis, because it is based upon common, but mistaken, concepts about promoting lesser-used species. On the one hand, the authors of the study appear to assume that there is an option to choose between the production of fine furniture for export and truck beds. In no way does that option exist. No business in La Ceiba is currently in a position to export and the companies in San Pedro Sula that do export are focused almost completely on mahogany. In reality, if **rosita** (*Hieronyma alchorneoides*) is not used for truck beds, there would only be marginal use of it for low-value and poorly-designed local furniture. Even if both alternatives competed against each other, the decisive criteria to whom the timber should be delivered to should be the price each buyer can pay for it. On the contrary, industries with a lower productivity would profit more. Added value can be taken into

consideration for evaluating the benefits of a certain industry, not to restrain the activities of others. If not, all industries except some handicrafts (that have the best added value rate) should be prohibited.

The death sentence for Atlantic Woods came with the devaluation of the Malaysian Ringgit. Suddenly, Malaysian competition was in position to offer products some 30% cheaper. Because 60% of Atlantic Woods costs were for wood alone, their ability to reduce costs was minimal. The owner is convinced that if conditions improve, meaning if suppliers are able to improve their product (which in light of the high volumes consumed would normally be expected), Atlantic Woods could continue in the market. Things being what they are, the customers of Atlantic Woods are now buying from Malaysia. Atlantic Woods has suspended production in the hope of better times and community forestry producers are losing hundreds of thousands of dollars each year, the only option being to illegally sell their wood at a loss.

AGRO DOS RÍOS (NICARAGUA): SALES WAREHOUSE FOR LESSER-USED SPECIES

One of the most successful marketers of lesser-used species are those businesses that work with outside capital. This implies access to knowledge and experience from outside the region studied. It is interesting to note the factors that affected success of these businesses in the promotion of lesser-used species. Agro Dos Ríos is such a company.

Agro Dos Ríos is a company located in Nicaragua which was set up with Costa Rican capital and management. From their home country, these managers are able to handle a wide range of species, many of them falling in the category of lesser-used. In Nicaragua, the company buys standing timber and controls all production steps. This helps them to reduce costs and make decisions early in the process that make sense later in the process (e.g. bucked log lengths).

Although Agro Dos Ríos exports the majority of its production, it has a sales warehouse on the highway between Managua and Granada. This

warehouse is supervised by a highly knowledgeable manager, Don Ricardo Montero, who has a real understanding about how certain species can be best utilized. Don Ricardo has an impact on the front end (advising buyers) and on the back end (defining production procedures for the various species with respect to the most promising products). The ability he has to impact both directions, and at the same time foster links between production chains, is obviously of major importance.

The actual point of sale for lesser-used species differs greatly from the typical point of sale for other broadleaved woods in the regions studied. Usually, there is poor service (e.g. no re-saw, planing, or delivery service), limited product line, and doubtful wood origins (see Box 33 and chap.6.4). In contrast, the warehouse of Agro Dos Rios has a good display of products, offers excellent assistance, good combination of services, and a large array of finished products as laths, siding, and various molding products.

The Agro Dos Rios example highlights three necessary elements to successfully commercialize lesser-used species: The need to reduce costs, the ability to establish effective communication between links of the production chain; and the need for a person with the unique ability to intertwine the elements of production with market requirements.

PIQRO (QUINTANA ROO):

ADAPTING THE INDUSTRY TO FOREST POTENTIAL

PIQRO is a laminated flooring business that was originally funded by a Mexican development bank to take advantage of lesser-used species. The business began operations in 1989 with annual projected processing capacity of about 2.5 million board feet of sawn wood (which amounts to 15,000 m³). The business failed to produce a profit for more than five years. The business changed management and ownership on several occasions and stopped production for a prolonged period.

This phase of uncertainty ended when the company was purchased by its current owners, who have greater investment capacity and good management. In Mexico, this last point not only implies mastery of strictly business aspects, but also

the ability to manage difficult relationships with state entities and forest producers.

Following a testing phase, the new management decided to use exclusively wood imported from the United States. This eliminated problems linked to introduction of lesser-used species and simplified production by having a consistent wood supply with uniform quality. The first purchase of lesser-used tropical wood came after analysis of what ejidal sawing operations could supply and what the business really needed. One result of the analysis was that the grading standards used by the sawing operations made the wood unnecessarily expensive. Grading rules and a price acceptable to both parties were negotiated and trading began.

The species used were **tzalam** (*Lysiloma bahamensis*) and **machiche** (*Lonchocarpus castilloi*) for surface layers and **sacchacah** (*Dendropanax arboreus*) and **chacah** (*Bursera simaruba*) for core. Tests of remaining abundant heavier species were carried out in the following months, but only **chechen** (*Metopium brownei*) produced acceptable results. The wood supply mechanism functioned surprisingly well and sawing operations began to produce for much longer periods of time than ever before. The business began to seriously consider the possibility of establishing a “green” policy, in order to obtain supplies exclusively from ejidos with “certified” forest operations.

In the end, this didn't work for several reasons. First, the business discovered that certification was a weak selling feature in its market place. In addition, they discovered that suppliers in Campeche, Quintana Roo's neighboring state, were able to supply raw material at prices considerable lower than those of Quintana Roo. Also, the market favored a tropical species, **nabah** (*Myroxilon balsamum*), that is infrequently found in the certified ejido forests. Finally, pine from central Mexico is cheaper than the lighter woods used for the core layers. PIQRO has stopped buying from the ejidos with “certified” forestry operations at the present time and now buys from private suppliers whose sources are not part of the equation. This situation was also brought about in part due to other problems caused by suppliers (back orders) as well as the business (very late payments).

This experience exemplifies the difficulty of building commercial relationships between well managed community operations and private businesses with the ability to market lesser-used species. The interests of both parts often are too divergent and the willingness to collaborate is too weak to be able to follow a common strategy. Until now, companies and forest communities based commercial relationships on the production of mahogany. With the dwindling of this species, things are becoming more difficult, because lesser-used species generate much smaller profits than mahogany. "Green certification" is a big opportunity, but it remains to be seen if it has enough strength to orient the interests along the production chain towards a common strategy. Today, very few companies in the region are targeting "green" markets, and very few chains will be able to adapt to the requirements of export markets in general and certified markets in particular.

8.2 Improvements in marketing

In the regions studied, both the forestry operations and the private wood processing businesses that work with tropical woods have significant problems offering competitive products. This has serious impacts on their ability to introduce lesser-used species.

Various initiatives have been attempted to address this problem. They include:

- Initiatives that seek to improve the business ability of forestry operations
- Initiatives that attempt to facilitate sales of the forestry operations through non-vested intermediaries.
- Initiatives that seek to improve the competitiveness of the wood processing businesses

8.2.1 Improvements in the business capacity of forestry operations

There are several examples of attempts to improve the business capacity of community operations (see also chap. 6.2).

a) Noh Bec, Quintana Roo. Improving management capacity. At the end of the 80's, the internal structure of Noh Bec, which was established in agrarian law, was not different from other ejidos. The ejidal assembly, which included all ejido members, elected a Board of Directors (president, secretary, treasurer, and controller) for three-year terms. This group had a wide variety of responsibilities, including representation, conflict resolution, management of community funds, etc.

Noh Bec had clear management deficiencies. This became apparent when the ejido made its first attempts to sell lesser-used species. Changes needed to finance production, process the wood, and price the products were significant barriers for a long time. Many buyers learned through poor experiences that even the best-organized ejidos in the region could be problematic suppliers. Improvements were slow to come.

The most important factor in changing this situation has probably been that ejidatarios recognized they could not arbitrarily change people in decision-making positions. An inept or corrupt decision could mean significant losses for the ejido. As a result, they began to re-elect people who had done good work. This enabled the person to apply greater experience to problems, and increase his authority.

Afterwards came the establishment of a new organizational structure: the Technical Forestry Committee. Committee membership is named by the General Assembly, and made up of outstanding ejido members and outside technical assistance personnel. Its function is to prepare decisions that are later presented to for the assembly. In some cases, they can also make decisions independently. Not having to discuss all questions in an assembly of 200 ejido members, some of whom neither understand nor have interest in forestry related issues, has greatly reduced decision-making time and improved the quality of those same decisions. The establishment of the Technical Forestry Committee reflects not only organizational maturity on the part of the ejido, but also timely organizational work by outside technical assistance organizations.

The next step to improve management was creation of the post of Forestry Administrator. This is a full-time, paid position in charge of directing the technical aspects of the forestry operation. Previously this job was performed by the ejido president. The Forestry Administrator is contracted based on technical skills and not status in the ejido, and fills the position for three years. In this amount of time, considerable improvements in the quality of the forestry related tasks have been possible.

Along with these improvements in management, there have been progressive changes in financial administration. There is now a professional accountant with authority to demand weekly financial reports, which is the beginning of systematic cost accounting. In addition, management of the sawing operation has been assumed by a member of the ejido that has high status in the community and high management skills, which together give him considerable authority.

The assembly has also given salesmen sufficient freedom to negotiate on their own. This has allowed them to sell the majority of lesser-used species volume that remains at the end of the year from the sawing operations.

Lastly, Noh Bec decided to separate ejido administration and business administration. To do this they created a separate legal entity ("Sociedad de Producción Rural") which is made up of ejidal members and organized like a business. The assembly elects a council that can select and dismiss those in management positions. The effectiveness of the changes can be judged by the success of the forestry operation. In 1999, the volumes of lesser-used species sold doubled that of mahogany. After several failures exporting wood to "green" markets, the ejido was able to make a sale that satisfied a buyer, who subsequently increased his order for the next year. This makes Noh Bec the only ejido that is currently exporting directly without intermediaries.

b) Caobas, Quintana Roo. Radical change in the decision-making body. Like Noh Bec, the community of Caobas began around 1930 and was

declared an ejido at the beginning of the 40's. Initially, its population was mainly Mayan, but today it has a more heterogenous make-up. The ejido began with 113 ejidatarios. Now there are 307. Productive forest land is similar in size to that of Noh Bec. However, forests in Caobas were exploited a lot more than Noh Bec. Today, Caobas has just one-fifth (300 m³) of the volumes found in Noh Bec. Because there is a greater number of ejidatarios in Caobas, the distribution of earnings is much less (between 600 to 2000 pesos annually per capita compared to 18,000 pesos, approximately 1,800, USD) annually in Noh Bec).

In the last five years, the ejido of Caobas, just as many other large forest ejidos of the region, has developed an organization of forestry use that is very different from the previous organization. It has split into many smaller user groups, each of which has obtained the right to carry out certain forestry activities on their own and make certain decisions themselves.

The "forestry usage groups" are a way to address the weaknesses of the ejido production system, which in this case they tried to resolve through a completely new system and not, as is the case in Noh Bec, trying to improve the old one.

In the current structure, the commercialization of wood is under the control of the usage groups and not the ejido. To achieve this, the volume of mahogany available annually is divided between the usage groups according to their size, in such a way that each ejidatario receives the same volume.

To carry out operations, usage group representatives agree on one key person who then works with all the groups. The responsible person, called *jefe de monte*, first marks the area for the current year and divides it into blocks for extraction. This work is aided by forest technicians from the Sociedad Civil de Productores Forestales (see chapter 3.4). These blocks and the order in which they are to be harvested, first to last, are raffled among the usage groups. This decides which group works first and where, which group is next, and so on. This raffle also determines the volume of lesser-used species the groups are entitled to, since each group receives the num-

ber of cutting blocks necessary to fulfill their designated volume of mahogany and has the right to use all lesser-used logs above the minimum cutting diameter located in this area. There is never more than one group working at a time nor is there more than one cutting area in process. The *jefe de monte* works with the groups in all of the following tasks: scouting, marking, felling and skidding wood. Group members can bring their own machinery, but they are subject to the decisions of the *jefe de monte*. The decisions relevant to harvest issues are in the hands of just one person. The groups can, if they so desire, contract third parties to carry out the work. They can also sell the standing timber. While all the groups extract the mahogany on their own, and later saw it in the ejidal sawing operation, many of them prefer to sell the lesser-used species as standing timber. The sawing of wood continues to be the task of the ejido, which cuts the wood of the usage groups and charges by the foot. The profits from the sawmill finance the expenses of the ejidal president. The arrangement makes it difficult to improve the technology used in the sawing operation. It is clear that innovative capacity has moved from the ejido to some of the usage groups.

In Caobas there are eight usage groups, consisting of between 10 and 129 ejidatarios. The usage groups all have different orientations. There are groups that are highly motivated to improve their extraction and processing operations. Others have out-sourced the more difficult tasks and prefer to be leasers, even to the point of selling the standing timber. The usage groups are more homogenous than the ejido as a whole when it comes down to their attitudes about work and innovation. Hence, some decisions are easier than before. One result of this is, they generate and distribute larger surpluses from the forestry extraction. It should be noted that part of these surpluses come from a considerable reduction in investment in communal works (such as forest roads).

The usage groups are not necessarily better commercial traders than the old ejido. The internal structures and working procedures of the groups are nearly the same. However, within the group, there is a greater sense of unity (which stems

BOX 37

An example of a hardwood sale in the ejido of Caobas

In 1998 an order for hardwoods was received from a private buyer in a neighboring ejido. First approach was to the president, who called a meeting of the 6 group leaders. They named a representative (in this case the forest manager) to negotiate the terms of sale. Harvesting was carried out jointly and the delivery was made as if it were from one sole supplier. Income was then divided proportionately.

from the voluntary nature of the groups and the competition among them). Added to this is a greater sense of responsibility on the part of the leaders, which positively affects marketing efforts. A major problem emerges with the separation of extraction (now controlled by the usage groups) from sawing (still under control of the ejido administration). Communication among these production steps, which are essential for the promotion of lesser-used species, is weakened. The sales of the usage groups are accomplished in an independent fashion for small orders; however in a joint fashion for larger ones. A significant volume of the sales made outside the region (i.e. 100% of the mahogany and 50% of the heavier lesser-used species) are channeled through the *fondo de acopio* (see box no. 38). This office makes a prepayment to finance production and is the point of contact for buyers. There are no up-to-date records maintained of recovery rates and costs which makes it difficult to establish prices, especially for lesser-used species that do not have established market prices.

The diverse management capacity of usage groups means varying levels of ability to market lesser-used species. While some groups have stopped selling these species, or sell them as standing timber, other groups have had some success selling them as roundwood or even as lumber.

e) *Layasiksa*, *RAAN*, a community with eroded internal structure. The community of *Layasiksa*, Nicaragua has a completely different context than the ejidos described in Mexico. While the ejidos were supported for decades by the Mexican government, *Layasiksa* was involved in a civil war that impoverished the entire region. While *Noh Bec* and *Caobas* have asphalt access which allows delivery of all sorts of merchandise from the rest of the country, the community of *Layasiksa* has to transport merchandise for five hours on a boat to reach the city of *Bilwi* (*Puerto Cabezas*), which is connected to the rest of Nicaragua by a poorly maintained roadway system. In general, all basic social indicators (e.g. infrastructure, health, and education) reflect a much more difficult situation for *Layasiksa* than the Mexican communities.

The internal structure of *Layasiksa* as well as most other indigenous communities in the *RAAN* has been eroded by the war and continues to erode, in large part due to loss of authority of traditional institutions (e.g. Council of Elders) and successful efforts of the municipal government to centralize power (see Box 7). In this situation, *Layasiksa* almost completely lacks its own decision making, representation, execution and control. All of which have had adverse effects on its potential to plan land use and negotiate with foreign entities (wood buyers).

The community works with a project financed by World Wildlife Fund (WWF), overseen by the Fundación para la Autonomía y el Desarrollo de la Costa Atlántica de Nicaragua (FADCANIC). This project is basically a forestry project, but the NGO has worked intensely, but cautiously, within the community organization to help develop decision-making structures. Following intensive groundwork, the traditional leaders (Council of Elders) and emerging leaders (a judge and the municipal representative) selected members for the newly established Committee for Communal Improvement. These members in turn named 30 people to work in the forest. They are now seeking people that can manage administrative matters, finances in particular.

The Committee for Communal Improvement and the communal assembly selected a forested area to examine for forestry operations. Based on

the analysis, they conducted a forest inventory on 3000 hectares. People were trained to do this and the most capable were named communal technical aids. During this phase, no one was paid. However, for the preparation of the yearly operations plan, technicians received payment. In this case, the operations plan (the prerequisite to get felling permits from the government) is the property of the community. This represents an exception in the region, where most inventories and operations plans are generated by *madereros*. The work has been long and tedious, but demonstrates that even in a community with an eroding social structure, it is possible to establish adequate decision-making mechanisms.

8.2.2 “Bridge” initiatives

Frequently, community forestry operations are united under one organizational umbrella which has the task of representing the operations, providing technical assistance and attracting development funds. These organizations have given strong impetus to marketing of forest products. Despite not being marketing experts, forestry technicians usually have more business ability than community members of forestry operations. This is not only because they are better trained, but they also hold their positions for longer periods and interact more with people attuned to marketing of wood (e.g. have contacts in cities). The technicians have sought and found customers for the products the communities can supply, supported communities in negotiating beneficial agreements, and assured that the wood purchased arrives at its destination.

Several problems have arisen during this work:

- *Control of sales*: Although the communities desire support in the search and maintenance of customers, they do not necessarily want to hand over control of the actual transactions. This fact has frequently highlighted differences between the desires of the technicians and the realities of the farmers.

- *Questions of technical leadership:* It appears cooperative organizations in other countries, such as in the United States, understand that technical and administrative decisions should be made by persons with the appropriate set of knowledge, skills and experience. This is not always the case in communities in Mexico and Central America. Some external groups think that community members, with little or no training, are able to technically manage their forests, process logs, and conduct marketing. This perspective appears based on the idealization of the potential, behavior, and knowledge of community members. In light of the significant challenges facing community forestry operations in coming years, this may be an irresponsible stance and in the end harmful to the communities because they will be left out of the market. If communities want to participate in unsubsidized commercial systems, they will have to learn to accept technical leadership and redefine areas in which democratic decision making is truly important. Based on this perspective, the best way to promote participation of communities in technical decisions has been to open the technical groups to the children of community members. Instead of delegating technical functions to the communities (who can only halfway perform them) encourage formal training for the youth of the communities. One example of this is found in one of the more important organization in Quintana Roo. The technical leader and several forestry technicians are sons of community members.
- *Limitations of technicians:* Technicians are limited in time as well as knowledge to do all the work related to marketing. The technical assistance groups were formed to undertake forestry related tasks and not administrative and marketing tasks. Since, in general, nearly all businesses in the forest sector are late-comers to marketing, hardly any of the technical assistance groups have personnel trained in this discipline.

Because of the growing importance that marketing and forest trade have in communities, special marketing entities have been developed in the umbrella organizations (described in chapter 3.4). In Mexico, they created various *fondos de acopio* (microcredit programs- see box no. 38). In Guatemala, cooperatives formed the *Sociedad Comercializadora de Productos Agro-forestales*, an organization that markets diverse forest and agricultural products.

8.2.3 Promotion of the secondary industry

Promotion of the secondary industry in the regions studied has generally been limited to isolated measures and lacks an overall vision. Usually, promotion is a secondary objective in a vague and generic promotional context. It is true that forestry operations have promoted vertical integration, training institutions have taught carpentry courses, and some chambers (guilds) have organized participation in trade shows and export initiatives. However, these measures remain isolated without some type of organization, and are limited to conventional options like training, assistance and financing. In reality, promotional initiatives in these regions have been a far cry from the type of integrated programs for industry promotion found in other regions or countries.

This situation is changing with the advent of discussions about industry clusters (cooperation between nearby businesses) in Central America and Mexico. This discussion revolves around synergies that can emerge from close proximity of various businesses. This has given industry an idea of the importance of analyzing its current position and setting a direction for growth. There appears to be ample room for outside assistance in this area.

8.3 Vertical integration

Vertical integration (establishing control over the preceding or following production steps) is a common strategy in volatile environments where a player has little influence over others and there are limited

possibilities for planning. It increases control over extraction and processing and can often reduce costs and risks. However, in more developed economies, where transaction costs are less, the more successful small- and medium-size businesses tend to be more specialized.

Vertical integration is a “natural” strategy for both forestry producers and external decision makers. It is often the first strategy considered and one in which people are inclined to invest larger sums. This is due to ideological reasons (value-added), psychological reasons (new machinery and equipment), and practical reasons (donors are more likely to buy carpentry equipment than pay for an accountant that could put the operations accounting books in order. It is easier to show proof of a carpentry workshop than a well-balanced general ledger). In many cases, the players lean toward vertical integration because they simply do not know about other alternatives for increasing revenues and creating working opportunities.

About 50% of vertical integration investments fail in the environment of community operations. The argument for “value-added” quickly becomes only a theoretical concept. Issues such as the difficulty in organizing production, logistics of distant markets, and problems of insufficient knowledge become factors working against success. When processing is inefficient, whether it be in extraction alone or extraction and sawing, it may be a poor idea to try to resolve such problems through vertical integration. In these cases, working to improve the current organization may be preferred. Nevertheless, in instances where vertical integration has worked, there have also been significant advances in the sale of lesser-used species, since more “value-added” increases the geographic radius of potential customers.

There are positive and negative experiences at all levels of integration. However, the results of the first phases of processing (extraction and sawing or rough sawing and extraction) have generally been more positive. The risks of a project’s failure are much greater in the subsequent steps of drying and secondary processing.

The integration of secondary processing operations has taken two forms: True integration, in

which the community operation establishes a secondary processing operation, or an independent family or group carpentry operation who in turn sets-up supply agreements with a community business. The community carpentry operations usually work with mahogany, while some family operations within the community mainly work with lesser-used species.

The most frequent mistakes in vertical integration projects have been:

- Projects are financed that lack community support, but are accepted by the community because they are free. When the machinery is installed, there is no one interested or able to use it.
- Lack of knowledge about how to orchestrate a modern industrial project in a rural-community. The need to adequately analyze market conditions and organizational aspects is under-estimated, and the general belief exists that buying machinery is the answer.
- Institutions that finance the purchase of equipment and machinery (donations and loans) give money for purchases and eventually for later training; however, they rarely make money available for working capital, and consulting related to equipment purchases or sales trips.
- Technicians over-estimate their ability and knowledge to make machinery-purchasing decisions and lack qualified advisors. Hence, much of the equipment purchased is not suitable for the intended purpose.
- Once money is freed-up for the project, timelines for spending are frequently imposed by donors, and consequently decisions about spending thousands of dollars are made too quickly.
- When the community makes the decision to buy, they often lean toward the cheapest equipment, even though it is used and in poor condition. Needed repair costs are difficult to determine at the time of purchase.
- Little serious marketing planning for future production takes place. Hence it is difficult

BOX 38

Fondo de acopio (microcredit program/Quintana Roo): steps in the right direction

For many years, wood traders have pre-financed the extraction and sawing of mahogany. The same is not true for lesser-used species. The profit of lesser-used species is not enough to cover risks and financial costs. Businessmen in search of lesser-used species (especially for flooring) prefer to buy in Campeche (a neighboring state of Quintana Roo), since the wood is cheaper and sawmills are in private hands, and as such the operation does not require pre-financing.

To solve financing problems and assist marketing, a microcredit fund was established with the help of various entities to finance deals involving lesser-used species. The original idea was to establish a warehouse of sawn wood in each ejido, which could supply buyers as soon as they placed an order. This was soon modified to pre-finance ejidos for firm orders. At the same time, it also included the necessary technical assistance to move orders forward, such as for log quality control, bucking, sawing procedures, and machinery maintenance.

The mechanism by which this works is an agreement between the ejidos or groups in the ejidos with the microcredit fund. The ejido or usage group agrees that buyer payments will go into the microcredit fund in exchange for a line of credit (working capital) for production of logs and sawn wood, and technical assistance. An interested buyer negotiates the price of the wood with the ejido or usage group, but makes payment to the microcredit fund. The buyer also has to promise to pay five Mexican centavos (about half cent per dollar) into the microcredit fund per board foot sold. This is equivalent to less than 1% of the value of the wood. An extension technician that has the community's confidence supervises the production process, quality issues and delivery times. Once the contract is signed, the fund frees up the credit (generally less than \$5000- USD) and production begins. The first buyer payment is made when the wood is sawn and final payment is made within thirty days.

This financing tool has proved very effective. Production of lesser-used species grew at a significant rate, especially those that had markets. It has also generated better prices for the wood. Currently, seven species are sold: **tzalam** (*Lysiloma bahamensis*), **chechen** (*Metopium brownei*), **machiche** (*Lonchocarpus castilloi*), **amapola** (*Pseudobombax ellypticum*), **sacchacah** (*Dendropanax arboreus*), **chacah** (*Bursera simaruba*) and **santa maría** (*Calophyllum brasiliense*). In 1999 more than three million board feet were sold.

Problems with this financing mechanism include:

- Low re-payment by customers and lack of legal recourse: This has to do with lack of firm direction regarding the granting of credits. Individuals in one ejido took pre-payments and used them for other ends.
- Knowledge gaps: The employees of the fund were named on the strength of the confidence of the community, not their technical or marketing skills. No training was provided. Consequently, the person responsible for marketing had shortcomings that might have been resolved with marketing, micro-credits management or English courses. These problem limited success in accessing export markets.
- A deficient organization: The fund is successful for its size in spite of poorly laid-out direction and guidelines (\$150,000 USD). Monitoring and evaluation systems do not yet exist and the lessons learned have not been incorporated. Neither is there a code of conduct nor clear objectives for the technicians: Some basic questions remain unanswered, such as: What policies for granting credit should be followed? What policies for recuperating funds should be implemented? What marketing and promotional activities should have priority? What should be the impact on the business structure of the ejido?

to establish realistic machinery needs. As a result, machinery often has excess capacity, unnecessary functions or more importantly, lacks needed functions.

- Production lines are planned as if they were to be built in a developed country, neglecting any organizational and social constraints in developing countries (See chap. 6.2).
- Still another frequent error has been thinking about a carpentry operation before consolidating extraction and sawing operations.

8.4 Improving recovery rates and taking advantage of by-products

A manager has several possibilities to improve competitiveness of his or her business and products, many of which are simpler and more inexpensive to implement than vertical integration. For example, a good manager will analyze alternatives for making the current production more efficient. Some options could be reducing costs, increasing recovery rates or increasing worker output. Another alternative is making use of by-products. Regional experiences mainly involve two of these strategies: Introduction of by-products and increasing recovery rates. These two strategies are interrelated and cannot always be clearly differentiated. For example, the relationship of volumes of various qualities of sawn wood and the by-products is not fixed. The desirable approach is to increase volumes of the best quality (recovery rate).

The rate and degree of use of by-products, as well as the ability to improve these two parameters are closely linked to the method of the forest production. Operations that produce motorsawn/rough hewn wood and those that sell standing timber, generally have developed fewer lines using by-products than operations that work with more expensive processing techniques. Community operations can be divided into five groups (see Box 40) according to their primary product and characteristics of production. Each group has a certain capacity for making their processing operations more efficient.

The community operations that pertain to Groups 1 and 2 (see Box 40) rarely use by-products originating from rough cutting or axe hewing of wood. Recovery rate of the main product is relatively reduced, since production of pre-determined lengths implies leaving undersized sections BC (see Box 41) unused on the forest floor.

The community forestry operations that pertain to Group 3 of Box 40 aren't very dynamic in their use of by-products. In general, they have limited interest in improving recovery rates, even though they frequently extract the large branches (section DE/Box 41). They do not take care in bucking (cut C/Box 41), as a way to raise recovery rates. Bucking is done to improve transport of the roundwood. In many cases, this results in abandonment of short log segments in the forest.

The operations of Group 4 have started improving recovery rates and the use of by-products. For these operations, just as in those of Group 3, recovery rate depends on several factors:

- In the felling and extraction, recovery rates depend on the quality of the log segment (soundness, shape, and defects), the techniques for felling, and the requirements of the main product.
- In primary processing, the quality of the log segment, type of main product produced, processing techniques, machinery maintenance, and the abilities and knowledge of the operators are important.

The case of Noh Bec exemplifies the limitations and possibilities of an operation to increase recovery rates and use of by-products. In this case, it deals mainly with improvements made around the use of mahogany.

From 1954 to 1981 the forestry operations in Noh Bec were carried out by an external plywood business (MIQRO). Since the business mainly peeled logs for plywood, stumps and log segments with rotten centers or holes were not acceptable. This meant that the felling cut (cut A/Box 41) had to be high enough to avoid some of these problems (120 cm or higher). At the same time, log segment lengths were based on what was needed for peel-

ing, that is to say in multiples of 260 cm, which meant loss of shorter log segments. Unlike other wood extraction operations in the region, they took advantage of thick branches.

When the community operations won control of wood extraction, for the most part they maintained the same criteria for felling and bucking. Even in 1984, when they installed their own sawing operations, they continued doing so. This did not change until Noh Bec decided to do a study to verify the efficiency of their extraction process, specifically of mahogany. This study, completed in 1991 (Ramírez, Gutiérrez, Sánchez, 1991), produced alarming results. Due to deficient scout-

ing, a little less than one-fourth of the mahogany trees were not found for felling. These trees remained in the forest and ran the risk of developing rot and disease problems during the 25 years span before the next cutting cycle. Many branches that could be used for sawing were left in the forests (section DE/Box 41, minimum diameter of 35 cm). Because of this, the volume extracted per hectare only amounted to 75% of what could have been extracted on a sustainable basis. In addition, the volume of wood discarded due to careless bucking at the log yard was greater than had been estimated. There were also logs found in the forest that had been felled, but for whatever

BOX 39

Women artisans (Quintana Roo): The ups and downs of promotion

In the mid 80's, when forestry usage in Noh Bec was consolidated, the towns people began to take an interest, individually and as a group, in producing more elaborate products, (furniture and handicrafts). Several initiatives took root at both these levels.

An interesting initiative was the promotion of wood processing by women. A U.S. artist, Sarah Eoff, taught the wife of a carpenter from the town, Doña Gloria, how to use the lathe in his workshop. In the end, she could make cups and plates of amazing quality that she and her husband sold in the nearby market of Chetumal. The success of this initiative was the motive behind financing broader application of the initiative: To seek new markets, include more women from Noh Bec and other ejidos, improve the machinery, and improve safety. To achieve this, they had to overcome several obstacles.

It was foreseeable that the women would have difficulty selling their products outside the region. A less predictable factor was that the women had to obtain the right to leave their homes to work on the lathes, and not all were successful. Some women became discouraged when they saw that

their first products were not sold. Another important potentially negative factor was lack of cohesion within the groups. Many women preferred to work individually or within their family. Still another problem was that the women lacked a well-defined relationship with the ejidos concerning raw material. Would they buy it? Would the ejidos donate raw material to them? These issues were slowly resolved.

A marketing structure, created in collaboration with a national promotional organization for artisan crafts was established. This guaranteed sales of a portion of the production. The external organization came to accept the fact that in this case, the best organizational structure was a family one, with the lathes under the control of at most two women. This obviously elevated the costs of the investment for each woman who participated. As for the wood supply, the assembly of *ejidatarios* decided that the women could take wood left-over after felling activities conducted to obtain logs for sawing. Currently, the women and associated technicians are discussing how to improve the quality of their products (dried and finished) without raising prices.

reason had not been extracted. Lastly, they discovered that the practice of setting stump heights 80 cm or more considerably reduced available volume for sawing. Unlike plywood production, a sawmill can use a large portion of a log, even if the center is rotten or more of the base of the shaft is included. On the average, Noh Bec was losing 0.122 m³ in every stump cut too high.

Losses due to poor utilization of stumps, branches, and felled but abandoned log segments are summarized in Box 42.

After extrapolating the value of the waste and trees not found, they came to the conclusion that the forestry operation had lost more than one million dollars over seven years.

As a result of this study, the two forestry operations began to make efforts to locate all of the trees in the area, placed the felling cut as low as possible, and used all the main branches. They also kept track of felled volumes on-site rather than in the log yard after the screening on the gathering yards. Hence the volumes extracted more closely matched those authorized in the operational plan.

The next advance in use of by-products came with demand for a specific product: Beehives. Beehives have to be light and resistant to climatic extremes and mahogany is well suited for this use. The required parts are small. In the beginning, the ejidal carpentry shop took advantage of waste in the sawing operation; however, this soon proved to be insufficient. Then they began recover the secondary branches of mahogany (section FG/Box 41 - minimum diameters of 16 cm) from logging sites. What is important here is the fact that the community operation did not carry out the extraction, but rather bought these branches from individual ejidatarios that organized the extraction and transport to the sawmill, which was possible because several of the community members had vehicles and the main road could be used year-round. Unlike the huge logs and large branches that had to be sawn on a large band saw, these branches could be sawn with small circular saws.

The ejidatarios also found a use for hollow sections that could not be sawn - flower pots for the homes of the people in Noh Bec, who are great flower lovers.

Another important activity already described is the production of artisan crafts by groups of women. The women obtained permission to extract wood from the forest, using branches of mahogany or lesser-used species, from trees felled for sawing. The importance of the agreement between the women and the ejidal assembly should not be underestimated. It is often this aspect, where initiatives encounter major problems.

A trip to the forest of Noh Bec confirms that all primary and secondary branches are being used and the felling cuts are made at the lowest possible point. They are not yet using branches under 16 cm (section HI/Box 41 - minimum diameter of 7 cm). Neither are they using the forks nor the buttresses, because in Quintana Roo they are generally very weak.

The volume not currently utilized during extraction of mahogany is estimated to be about 5% of the total volume actually extracted. There are several potential uses for this un-utilized volume: The forks (sections CD, EF and GH/Box 41) have an attractive grain, but are difficult to process. They are not useful for beehives due to changes in the direction of the fibers. This makes them difficult to turn on a lathe, as well. The best possible use of these is in the production of artisan crafts, in particular those worked on a band saw (see Recommendations).

There have been important changes in sawing practices as well, although many aspects require improvements:

- They have improved stacking which reduced losses due to fungus and insects attacks.
- Band saw maintenance has improved (e.g. better sharpening, changing saws before they wear out, and proper feed rates), all of which have reduced loss due to damaged wood.
- Operators on the edge trimming and cut-off saws have more experience than before, however they are far from turning out optimal work in the current circumstances. In the case of the edge trimmer, lack of optical aids could easily account for 3% of the losses at this point. In the case of the edger/chop saw, lack of knowledge regarding international grading standards leads them to cut more

BOX 40

Types of operations, by-products and recovery rates

Main product

Characteristics of production

Group I

Motor sawn or axe hewn wood with set dimensions: i.e. production of railroad ties in Quintana Roo
Coef A: 30 to 40%
Coef B: 20 to 30%

- The main product has set dimensions for length and width, which imply that a significant portion of the piece remains behind on the forest floor. Section AB (see Box 41) is utilized.
- Commercial by-products are nearly non-existent.
- Sawing takes place in the forest. The wood products are transported by simple means and there is little incentive to take out by-products, even for domestic use.

Group II

Motor sawn wood with no set dimensions and use of a chainsaw guide i.e. some operations in the Atlántida
Coef A: 40 to 50%
Coef B: 20 to 45%

- The main product has variable dimensions, which allows extraction of the majority of the log.
- The rest of the characteristics are the same as in Level I.

Group III

Logs. Extracted volume is controlled in log yard
Coef A: 70 to 90%
Coef B: 25 to 45%

- Extraction with skidders.
- Frequently the larger branches are extracted (Section CD of Box 41). These branches are processed the same way as normal logs.
- The skill of the chainsaw operator is an important factor for recovery rates.
- Extracted volume may be above volumes set by the operating plan, because the wood is measured in the log yard after getting rid of low quality sections. Since allowed volumes are fulfilled with better quality wood, the incentive to use lower quality sections is reduced and a lot of waste remains in the log yard.
- This means that there is a lower recovery rate with respect to total extracted timber.

Group IV

Logs. Volume to extracted is determined in the forest
Coef A: 80 to 95%
Coef B: 25 to 50%

- Extraction with skidders.
- Many characteristics of the previous level, but now they begin to actively seek best use of the log. Since the volume is measured at felling point, and therefore the extracted volumes are a mixture of good quality and bad quality, the forest operations will tend to extract also the lower qualities to process them. The change in the controlling point usually is connected to other improvements:
- The height of the cut for felling is reduced from about 80 cm (which was the usual felling cut height for plywood production) to the height that the buttresses permit. Normally the trees in the region have little buttresses, so the cut is made just above ground level.
- The length of the second sections bucked (Point B in the blueprint) is no longer made based on means of transportation, but rather on how to improve utilization for later processing.

Group V

Active efforts to use by-products

- Some characteristics of the two previous levels.
- Market conditions, business attitude of the forestry operation or of small businesses in the community encourage use of by-products; i.e. smaller branches, hollow log segments with some rot or insect damage, etc.

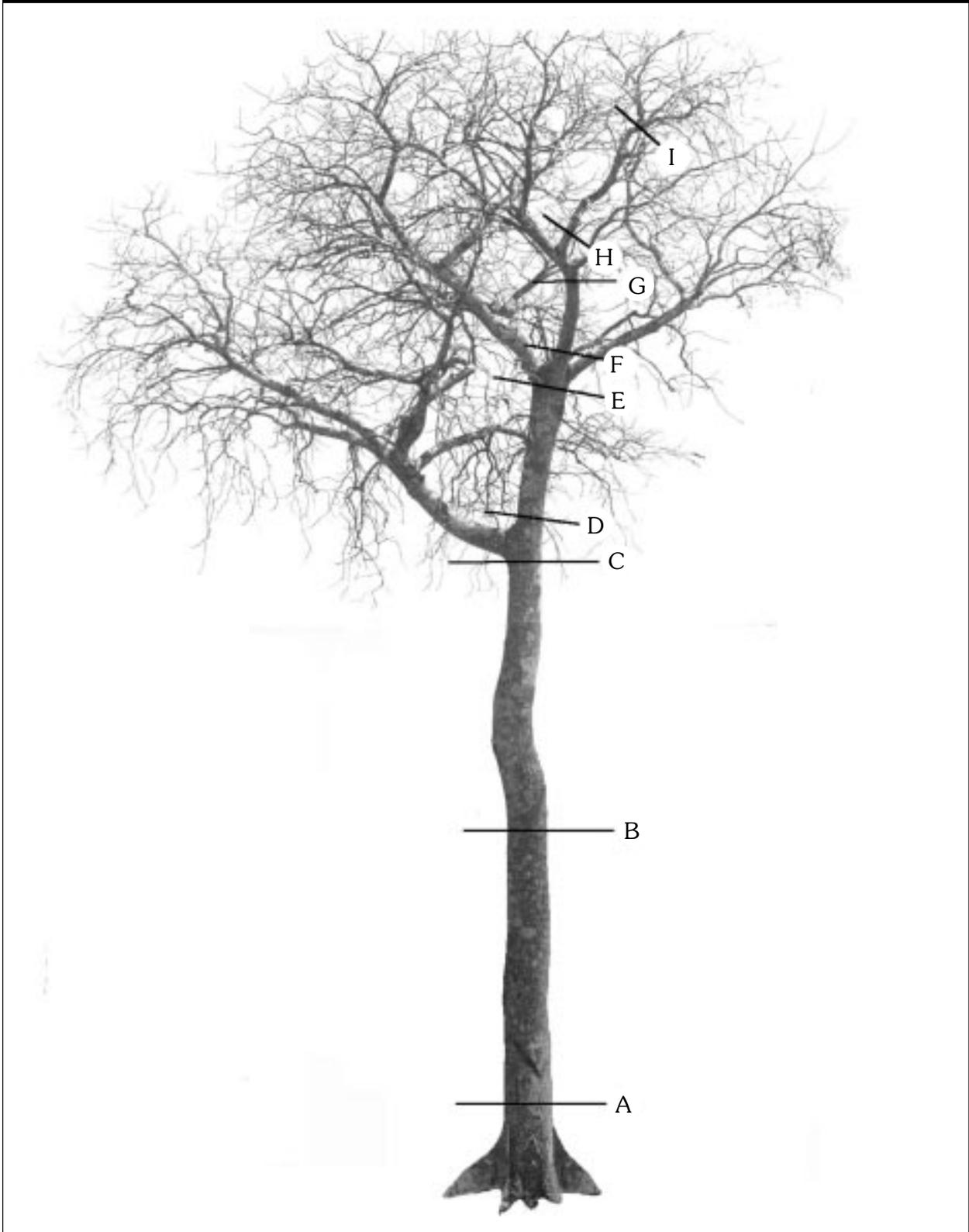
Coef A: Recovery rate for the extraction (includes motor sawing in groups I and II).

Coef B: Recovery rate added for extraction and sawing. (Includes re-sawing in groups I and II). At some points, presented number are estimations that need further substantiation by yield studies.

Source: primary research.

BOX 4 I

Sections of a tree



than is needed. This probably causes unnecessary losses of 4% or higher. An additional point is that the operators of the main saw lack the knowledge needed to optimize cuts, considering flaws in log segments, end uses, and esthetic potential.

- Bucking (cut B) has improved, but it is still done only to maximize production of longer segments. This strategy is possibly the best in light of the difference in prices between short and long boards (boards –5-feet and less are sold at half the price of longer boards), but perhaps not if the quality of the wood is taken into account (i.e. potential grade).

An important development in reducing waste in the sawing operation has been the emergence of small businesses directed by ejidatarios. Many of them have been sales representatives or ejidal president and learned a great deal about how to form a business and detect marketing possibilities. Several have begun to produce beehives, the same product as the community carpentry shops. In addition, many others have begun to produce handles out of lighter woods that have less resistance to impact (e.g. brooms and carpet beaters). In general, these small businesses are focused on low-value products that require low investment and that have regional markets. Their advantage is access to cheap raw materials.

In Noh Bec, the separation between activities that community forestry operations should perform

and activities handed-off to independent micro-businesses, which are usually managed by ejidal members, has functioned well. Generally, they have known how to distinguish between ventures that require greater investment, but benefit the entire community, and less profitable ones that can be picked up by private businesses.

The ejido of Noh Bec has achieved better recovery rates and greater use of by-products than have other community operations:

- Few community operations take as much care in the tasks involved in extracting logs. Many community forestry operations continue to “skim the cream” from their forest reserves.
- Few operations utilize the secondary branches (sections FG), since they do not have a large enough carpentry shop or enough disciplined workers to begin the production of beehives.
- In many community sawing operations, yields are unnecessarily low due to poorly adjusted machinery and poor maintenance. This could be resolved with little more than a willingness to improve. Again, the reason that these problems continue is not technical nor financial. It is found in the organizational structures described previously in the chapter about effects of management capacity on forestry operations.
- There are artisans in the other communities, but many work independently, only obtaining wood as needed without agreements with the forestry technicians. Byproducts are not used.

BOX 42

Wood extraction waste in Noh Bec 1988

Type	Percentage wasted*
Stumps	6.3 %
Main branches	10.2 %
Abandoned sections	0.5 %
Total Waste	17 %

*) Ex: For every 100 m³ extracted, 6.3 m³ remain in the woods as stumps.
Source: Ramirez et al. (1991).

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

Main opportunities and threats. The regions included in this study have significant potential to develop their forestry-wood products sector. In the short term, the regions could probably double their production of wood. Medium term, these regions could triple or even quadruple their production without abandoning good management of their forests, by using a sufficient number of species. Among outstanding regional strengths is the fact that many forestry communities have established good management of their forests (i.e. as indicated by “certification”). In addition, the regions have significant industrial infrastructure. Atlántida and Quintana Roo have large end-markets, and roads to larger markets improve annually in Petén.

In spite of these strengths, players in the forestry-wood products sector run the risk of becoming losers in the complex process of change brought about by regional and national modernization and the end of protectionist commercial policies. With few exceptions, forestry operations and wood processing businesses have lost market share in their traditional markets in the face of competition from other regions, and have not been able to penetrate new markets. Many businesses are clearly working below their production

capacity and some have closed. Instead of growing, volumes of broad-leafed species produced have declined over the last ten years.

Main problems. These negative trends have their roots in several structural problems.

- Limited business capacity: In general, regional forestry operations and wood processing businesses have limited business capacity. This is a classic problem that small businesses have when confronting larger ones. Nevertheless, there are certain regional issues. Regional isolation reduced competition for a long time; consequently, regional businesses have not grown because of improved productivity, but rather other factors (for example, access, often informal, to cheap mahogany). In the case of community forestry operations, the organization itself limits their business capacity (see chapter 6.2).
- Weaknesses in regional production chains: Obvious weaknesses remain in regional production chains. Without question, relationships between community operations and private businesses continue to be difficult. However, at the same time relationships between some private businesses and portions of the production chain demonstrate real possibilities for improvement. In several regions, tim-

ber trade is an especially weak link in the production chains. These businesses have a deficient internal structure. They suffer from low working capital, are often not legal companies, and offer a reduced service palette. Beyond this, their relationship with forest producers is weak.

- Land use policies and laws: Sectorial policies and regulations in some countries tend to inhibit forest use without improving protection of the forests.
- Technical Assistance: Unlike technical forestry assistance, which is often high quality, technical assistance regarding processing issues and marketing is weak, especially when it comes to community operations.
- Knowledge gaps: Some gaps exist with respect to technological characteristics of lesser-used species. Noticeably larger knowledge gaps exist with respect to the adequate use of marketing tools (see Box 34, for example).

These problems are not so obvious when regions have significant volumes of mahogany (*Swietenia macrophylla*), because the higher income earned from this species tends to disguise them.

These problems become critical though for lesser-used species that have significantly lower market value. For example, primitive financial arrangements that work for mahogany do not work for production of lesser-used species. These species do not generate sufficient revenue to compensate for higher costs and elevated risks inherent with more primitive kinds of financial arrangements.

General description of needed actions.

Clear changes in conventional procedures are needed to promote lesser-used species. It is not enough to technically support businesses in adopting new species and spreading this knowledge. It is essential to work to resolve the aforementioned underlying problems that impede commercialization of lesser-used species.

If community forestry operations and processing businesses want to increase sales of lesser-used species, they must improve their internal organization, and their relationship with other members of the production chain. Only after es-

tablishing a firm organizational base can businesses pursue resolution of technical problems.

Need for external assistance. Community forestry operations and processing businesses have made advances in resolving the aforementioned problems. However, it is obvious they will require external assistance to move forward.

Possibilities of interlacing other discussions and actions. The potential for external assistance and interlacing it with other regional development initiatives is high. Regional players, which includes governments, have begun to understand that they must develop industrial promotional strategies if they want to avoid damage from globalized markets to this all-important forestry-wood sector. Several discussions have sprung up that could be highly applicable to the promotion of lesser-used species.

- Industry Clusters: This concept involves the informal cooperation of several businesses with a similar production orientation to gain a competitive advantage and appears to have become the new economic orthodoxy in the four regions studied. The programs that have begun to plant this idea explicitly recognize the huge potential of the wood products industry.
- Forestry certification: This discussion seeks to take advantage of “green” markets in order to improve forestry management. Part of this concept entails “chain-of-custody” arrangements from “certified” forests and operations all the way through manufacturer inventories. This process could improve communication between the various players in the wood products production chain.
- Biological corridors: Actions in this area could also benefit the discussion about wood products production chains and promotion of lesser-used species since it could benefit key areas and communities.

Promotion of lesser-used species. Three of the four regions studied could benefit from promotion of lesser-used species. The one exception is the RAAN, Nicaragua, where promotion efforts might be counter productive to good forest man-

agement due to lack of forestry laws, guidelines, and enforcement. Here, the danger is that greater use of broad-leafed species could accelerate degradation of the resource. For this reason, the priority for RAAN should not be on promoting greater use of lesser-used species, but on establishing guidelines for forestry use.

In contrast, promotional measures for lesser-used species in Petén, Atlántida and in Quintana Roo would have positive effects on forestry management, industry development, and regional development as a whole.

9.2 Recommendations

For the time being, the promotion of lesser-used species should not necessarily mean incorporating more species, but rather increasing sales of currently-known species that are not used much in the market. Above all, defending market share for these species, which are faced with competition from products originating from other regions, should take precedence. Instead of trying to introduce new species, either new products from already commercial, but underutilized, species should be developed or existing products improved.

The central objective of promotional activities in Petén, Atlántida and Quintana Roo should be reinforcing regional production and distribution chains, and defending current markets. Work should be pursued at all levels of the businesses.

Below are specific recommendations:

- a) *Increase business capacity of community forestry operations.* It is important to improve decision making skills, improve products and services, and increase reinvestments. Successful models already exist which can be applied to other operations. With few exceptions, secondary processing should not be promoted among community operations. The activities to promote horizontal cooperation between community operations should focus on improving competitiveness, not on fostering price agreements, which can result in a sales cartel.
- b) *Improve relationships between community forestry operations and private regional businesses.* To avoid further ruptures in regional production chains, emphasis should be placed on facilitating transactions between community forestry groups and private businesses. All parties in a contractual agreement should commit to a higher level of compromise. The communities should reduce their dependence on advance payments and improve communication with other actors in the production chains. This is especially true for Atlántida. Here the regional wood and timber merchants (madereros) should be recognized as indispensable links in the production chain. The overall objective should be to combine the strengths of community forestry operations and those of regional private businesses. Here lies a significant potential to improve the competitiveness of regional companies.
- c) *Improve capacity of private businesses to orient themselves to market demand.* A large number of private businesses suffer from serious weaknesses. As long as this continues, these businesses will continue to lose market share. In this case, knowledge and application of marketing concepts will be of utmost importance (see Project Proposal No. 5).
- d) *Elevate quality of forest regulations.* Honduras and Nicaragua need to modify official regulations to facilitate forestry and wood production, and at the same time allow establishment of more sustainable forestry use. Existing experiences in the development of sound policies could be applied.
- e) *Reinforce technical assistance for processing and marketing wood.* It is necessary to establish industrial assistance in the forest organizations. It is also necessary to convince industrial chambers to cooperate with these organizations. Today, these two types of organizations have little contact with each other. Not only it is necessary to improve relationships between community forestry operations and private industry, but also to

advocate cooperation between those technical advisors that help these groups.

The focus of promotional measures for lesser-used species should be on regional markets and production chains, and in some cases national ones. Here is where, over the next ten years, the success or failure of commercializing lesser-used species from community forestry production will be defined. This does not mean completely ignore the export market. "Green" export markets are an attractive niche, but it is important to be realistic about the potential to access these markets. Today, of 150 existing community operations in the regions studied, fewer than five have potential to successfully penetrate "green markets" as direct exporters. The best alternative appears to be to seek improvement in regional production and distribution chains, and leave the challenge of exporting to private businesses or specialized NGOs. This requires the set up of chains of custody.

In the promotion of LUS, each region should set specific priorities:

- Atlántida: The focus should be on defending current regional markets for furniture, doors, kitchens, closets, etc. To achieve this, communication up and down and across production and distribution chains, and between small- and medium-size businesses will have to be improved considerably.
- Quintana Roo: It is important to improve communication in the flooring production chain (see description PIQRO). The national markets for sawn woods intended for flooring are important too. A significant market for lighter species appears to be the production of painted furniture and moldings. These could be produced locally. In addition, there is a growing regional market for round posts (see box 35).
- Peten: Activities should be oriented towards satisfying demand for flooring wood in eastern Guatemala. Since the cooperation between community forestry operations and private businesses has been successful, the export of sawn wood and decorative veneers can be envisioned (see chapter 7.3).

9.3 Recommended follow-up proposals

1. Micro-credit financing program for forestry production

General concept: This would be a program of micro credits to facilitate financing extraction and wood sawing. Micro credits would be subject to organizational and technical improvements in community forestry operations. They could be implemented with the support of technical assistance groups. This program is recommended for Quintana Roo, Atlántida, and possibly Peten.

Justification: This program addresses some of the major problems identified in this study. It will contribute to improving community forestry business capacity and relationships with private businesses.

Prior experience: This proposal is based on the outcomes of "fondos de acopio". These funds created a combination of financing and technical assistance. There is a weakness in these funds which stems from the lack of realistic goals and inadequate guidelines for awarding credits (see box 38).

Brief description:

- The micro credits (which normally would not exceed \$5,000 U.S., although it could be necessary to increase this amount to \$8,000 U.S.) would be managed by a trusteeship. The credits would be awarded to community operations or private businesses that perform the activities of extraction or first transformation. The credit would primarily be granted as working capital but would not be closed to other options (equipment purchase).
- To obtain credit, the applicant operation would have to demonstrate compliance with certain organizational or technical requirements. Requirements could include establishing an accounting system or designation of a production manager with certain technical abilities. Technical assistance providers, financed by a separate fund, would support applicants in meeting their conditions.
- To guarantee repayment of credits, a representative from the program would be present

during trading negotiations with clients. The technical assistance group would also seek out new buyers. Stockpiling wood, taking into account potential product specifications and storage requirements, should be considered to improve availability. This strategy allows access to buyers that individual operators would not otherwise be capable of because of their inability to carry financial risk and lack of organizational ability. For example, there is currently significant demand in Mexico for railroad cross-ties. Due to the nature of the demand (large volumes, strict quality standards, and need to pre-finance the production), community operators have not been able to offer bids. However, they could if they combined their efforts.

- The technical assistance group could be internal or external to the program. Besides the functions previously described, this group would facilitate communication and cooperation with private businesses.

Potential Partners: The initiative for the micro credit program should come from technical forestry assistance groups already in the regions. The proposal should be further developed with officials from national development banks along with international development agencies or international foundations. Financing could come from either national or international development banks.

2. Improvements in wood extraction procedures

General concept: Conduct practical studies and provide technical assistance to improve certain aspects of the extraction, mainly in Quintana Roo and Atlántida.

Justification: Current extraction methods in Atlántida and Quintana Roo seriously limit access to important markets for many producers. In Atlántida, the main problem is the crooked lumber that results from chainsawing without guides. Additionally, the transport of lumber by mule makes it necessary to limit lumber dimensions.

Both factors combined lead to a very low recovery rate on later processing steps. In Quintana Roo, current extraction methods require large investments. This means many communities are unable to afford financing for their own extraction. Beyond this, current operations have to reduce costs or improve production to stay competitive.

Objectives: Improve quality of wood transported from the harvest site to roads, reduce extraction costs, and facilitate access of community forestry operations to extraction using methods that require small initial investment and are geared towards smaller volumes.

Previous experience: In Mexico, a project with Great Britain revealed significant potential to improve information about extraction alternatives. It also produced information useful for developing new alternatives, one of which involved use of farm-forestry tractors that could also be used in the rainy season for non-forest related activities.

Brief description: First Phase - A local technical assistance group would initiate diagnostic studies of current extraction methods. Based upon these results, extraction experts would be invited to make recommendations to improve the process.

Second Phase - This would be an experimental phase in which community operations would modify current methods based on recommendations provided. The options with the most likelihood of acceptance among community operations would be determined.

Third Phase - The local technical assistance group would introduce recommended improvements communities.

Potential partners: Various groups of forestry technical assistance providers, community forestry operations, external technical assistance providers, and potential outside financing sources.

3. Developing primary processing products

General concept: Develop decorative veneer and improve production of sawn wood for businesses with the capacity to effectively use targeted technical assistance.

Justification: In the regions studied, experimentation with new timber species (i.e. defining

physical and mechanical characteristics) is much less important than developing and improving products that use lesser-used species. Decorative veneer may be a key product for lesser-used species due to increasing use of MDF in furniture production in these regions (MDF boards must be covered with veneer or synthetic surfaces both for esthaetical and practical reasons). Since the Atlántida region has a lot of furniture companies, the development of a line of decorative veneer is very important. It could also have positive effects in Quintana Roo and RBM. The veneer could be produced by existing plywood companies, which normally have a slicer (the most appropriate machine to produce decorative veneer). The problem is that many of these factories are currently closed.

In Atlántida, there are many hindrances for starting this line. On one hand, the only veneer production line in the region, which was originally intended for plywood, has been closed for years. On the other hand, the present method of wood extraction (rough-hewn lumber of smaller dimensions) makes it difficult to obtain the cant used for veneer production. The first problem could be resolved by transporting wood to a veneer operation in Tegucigalpa; however, the second one would require more consideration and may be difficult to resolve without better extraction methods. Given all this, it is recommended that this activity be tried first in Petén.

Objectives: Improve quality of flitches and develop decorative veneer product lines. Establish local teams to provide commercial and technical assistance to wood processing companies.

Previous experience: All regions currently have plywood manufacturing facilities with veneer slicers. With the exception of a business in Peten, specialized knowledge about decorative veneer production does not exist nor how to make decorative veneer from heavier woods.

General project description:

- Identify community forestry operations and private businesses with the capacity and willingness to translate recommendations into real production.
- Develop a group of industrial technical assistants and marketing experts.

- Encourage constructive interaction between local industrial assistants and external consultants.
- Implement proposal first in Peten, where private industry cooperation with community forestry organizations will facilitate the process. The local assistance group will carry out brief technical analysis and market studies. Following this, an external consultant will train factory personnel in the production of decorative veneer.
- In the same manner, the same process could be followed in other regions and for production of sawn wood.

Potential partners: Forestry technician groups or chambers interested in establishing industrial technical assistance program, external consultants, community forestry operations and private businesses.

4. Promoting wood commerce

General concept: Begin discussions focused on strengthening regional wood commerce.

Justification: Wood commerce, whether in log form, motorsawn, rough-hewn or sawn wood, is a weak link in nearly all the regions. Wood merchants very seldom are able to acquire banking credits because of the deficiencies in the banking system. As a consequence, their liquidity is low, forcing them to keep very small stock of wood for trade. Therefore, when a company orders lumber, it frequently has to wait till the logs are extracted from the forest and then sawn.

At the same time, the businessmen who deal with logs and rough hewn wood (the madereros) are frequently perceived as the “bad guys”, because many of them work informally. Forest producers often see *madereros* as people that unjustly get a huge piece of the pie.

Today, no region has a promotion strategy to support timber trade companies.

Previous experience: Until now, there has been little discussion about wood commerce. It is most often mentioned when someone is looking for scapegoats. In Quintana Roo, the “fondos acopio”

(micro credit program) attempted to partially replace timber merchants. The financing program (see proposal no. 1) might possibly have the same effect. Even if this approach worked in the short term, it is not a viable alternative for a competitive commercial timber trade in the medium- or long-term.

Objective: Conduct a detailed investigation of wood commerce and financing in the different regions and open up constructive dialogues with *madereros*.

General project description:

- The region that is most lacking in a constructive dialogue about wood commerce is Atlántida. Here the confrontation between the upper echelon of the forestry institution (AFE-COHDEFOR) and timber commerce is the greatest. A careful strategy to convince both the *madereros* and public officials to adopt constructive attitudes must be found.
- The need to increase size and reduce number of trading companies must be discussed. Timber trade in Mesoamerica is subject to the same concentration processes that occur all over the world. The question is how this can occur with the least damage.

Potential partners: The key promoters of this discussion should be neutral, for example CUPROFOR in Atlántida or the University of Quintana Roo.

5. Secondary industry promotion

General concept: Explore the possibilities, limitations, and impacts of technical assistance for the secondary industry.

Justification: In Quintana Roo and Atlántida, many secondary manufacturing businesses are losing market share to external competitors. To overcome this problem, the businesses need technical assistance. Several initiatives have been directed toward this objective, but have had limited impact, because they only addressed a small part of business problems and they were conceptually weak.

Due to the limited results in industrial promotion, no one really knows which promotion procedures work and which do not. Project managers still have a lot to learn to improve the impact of their activities. Therefore, this project would not only be directed at promoting the secondary industry, but would keep an eye on how this promotion can be implemented, trying out diverse technical assistance strategies (i.e. product development, production and/or commercial assistance).

Objective: Explore various means of industrial and commercial technical assistance.

Previous experiences: There is already some experience with industrial technical assistance in the regions studied, which could be the basis for identifying specific efforts.

General project description:

The following technical assistance alternatives are proposed:

- Conventional technical assistance: This assistance would be geared toward improving equipment in businesses and increasing worker skills.
- Product differentiation: Currently, businesses have limited range of products with little differentiation between one business and another. Their current strategy to retain market share is to reduce production costs, which often results in poorer quality. Products would be analyzed to determine ways to differentiate them by means of combining materials (i.e. metal, fabric, and leather), wood species, or use of better hardware.
- Product development: Regions do not have an efficient means of linking market requirements with the production possibilities of regional businesses in order to develop products. With the help of an external consultant, an exercise in product development should be carried out. Products with the greatest potential will be those that require final installation by a carpenter, such as doors, windows, closets, and kitchen cabinets. These products offer an advantage to small- and medium-size businesses where

larger or foreign businesses have not been able to excel (for example in Mexico City). It will be important to establish a relationship with an external source able to provide adequate advice about product design.

- Horizontal and vertical cooperation between secondary manufacturing businesses: There have been several initiatives to encourage horizontal cooperation, but few have had convincing results. In general, cooperation has been oriented toward supply aspects (joint purchases) or production (joint equipment purchases). Secondary manufacturers have not explored the possibilities of joint marketing (complementary product lines, consistent quality standards, common brand, and joint publicity).

To begin with, production and marketing tests are recommended directed at micro and small businesses for production of entrance doors. Doors are a common product for these businesses, but there is a danger they will be displaced by larger businesses that import finished doors. The doors would be designed in such a way that a small- or medium-size business could produce parts, leaving assembly to micro businesses that can make custom-made doors to the dimensions needed. To be able to do this, technical and organizational assistance will be required on both ends. The result will be a combination of the technological ability of medium-businesses with the marketing abilities of micro-businesses. This development would not only allow practical experimentation with other species of wood, it would also provide guidelines for the organization/financing of technical assistance. In addition, it would allow discovery of product development problems, distribution potential, and potential for cooperation among various businesses.

Potential partners: In the Atlántida, CUPROFOR has an excellent administrative and physical infrastructure for accomplishing tasks of this nature. However, they do not have the conceptual or operative ability to carry out this type of activity (i.e. lack of adequate personnel). Here it will be necessary to strengthen CUPROFOR with external

personnel. In Quintana Roo, technical assistance could be directed by a technical forestry group.

6. Production and marketing tests: Motorsawn and handhewn wood beams and planks

General concept: Conduct systematic market surveys and production tests for rough sawn and handhewn wood beams and planks.

Justification: Traditional markets for rough sawn and handhewn woods are diminishing. This weakens communities that do not have the ability to establish manufacturing processes. At the same time, these operations are less able to meet modifications proposed by potential customers. Do possibilities for creating production links between these operations and new groups of buyers exist? A beam worked with an axe and planks roughed-out with a chainsaw has a certain esthetic quality that the conventionally sawn lumber lacks. These products could be used for exterior or interior architectural accents where a rustic effect is desired.

Objectives: Identify new markets for motor-sawn and handhewn wood, and eventually set up the first steps for entry into these markets.

General project description: Identify potential markets for rough cut and handhewn beams and planks made from heavier lesser-used species. These products were produced for many years in central Quintana Roo, generally by Mayans, for use as railroad crossties.

- Analyze production costs and recovery rates.
- Assess production potential and limitations of the community operations, including the potential to aggregate production of several communities, and their capacity to adapt products to specific requirements of new buyers.
- Identify potential markets and contact interested businesses.
- Test market products. Samples would be sent to potential buyers. Verify production capacity of communities and introduce interested businessmen, who would eventually be in charge of the marketing.

These activities have the secondary goal of reinforcing marketing knowledge and abilities in the regions studied. They strongly emphasize learning, which would place heavy importance on monitoring activities.

Potential partners: Work could be started with producers in Quintana Roo.

7. Production trials with lesser-used species

General concept: Work with selected secondary manufacturing businesses to test new wood species in their production lines.

Justification: In general, businesses have tested most species that are of interest to them. This study would help businesses examine species and opportunities that they may not have previously considered.

Objective: Increase use of certain lesser-used species through practical manufacturing and marketing trials with secondary manufacturers.

General project description: Selected businesses would be provided a certain volume of lesser-used species and given the option of technical assistance for particular problems. An external consultant and the businesses themselves would conduct and evaluate the process of introducing the lesser-used species. The actions taken would outline costs and necessary raw materials for substitution of a previously used species. It is proposed to assess substitution of **pucté** (*Bucida buceras*) for **chichipate** (*Sweetia panamensis*), for the production of flooring in eastern Guatemala; **malerio** (*Aspidosperma sp.*) and **luin** (*Ampelocera hottlei*) for **encino** (*Quercus sp.*) for door production in Guatemala. There also are several species that the furniture industry is not aware of in Atlántida.

8. Proposed themes for discussion

Potential regional partners, such as communities, businessmen, technicians, officials, and extension personnel should come together to discuss several topics in order to come to a consensus about development strategies.

- There is a strong need to discuss and improve regulatory guidelines for forestry use and “madereros” in the RAAN and in the Atlántida. The situation is especially difficult in RAAN, where the regulatory authority is divided among many levels, and indigenous communities, who are key participants, lack representation. In the Atlántida, it will be necessary to hold discussions regarding the appropriate model for technical assistance, regulation of community use, and road control points.
- All the regions need to broaden and fine tune industrial development strategies. They are taking important steps in this direction with discussions about “clusters”. Nevertheless, many initiatives have stagnated after poor diagnosis of current situations and unconvincing procedures for development of strategies (e.g. indiscriminate use of participative methodologies). There is a need for experienced regional industrial development consultants to conduct a high-quality regional diagnosis.
- Businessmen and communities could improve their relationship by discussing the possibility of chains-of custody. Beyond the technical aspects of the management of certified wood, this discussion could increase understanding among these regional participants, and facilitate transfer of information about market needs and product requirements.
- It will be important to discuss a different division of labor. Instead of attempting to own all the production links, from extraction to secondary processing, communities and private business should seek specialization and gain economies of scale rather than “value added”. To do this, they need to discuss how to reduce costs, transaction risks, and once again, how to adapt characteristics of the product to requirements of later production levels. These discussions should include grading systems, required dimensions, and distribution of deliveries over a year’s time.

9. Proposed technical studies about lesser-used species

- Anti-Fungal and Insecticidal Treatments: Treatments are needed for wood susceptible to insects and fungus that are economical, effective, and do not require extensive safety precautions. On several occasions, local knowledge about treatments have been encountered, but they are not applied. It is recommended that these local treatment techniques are investigated regarding costs and efficacy. In the event adequate treatments cannot be found, other treatments will need to be used, usually involving synthetic chemicals.
 - Petén and Quintana Roo: Environmental and social impact studies are recommended in order to evaluate feasibility of extracting **ramón** (*Brosimum sp.*) and **chicozapote** (*Manilkara zapota*).
 - Quintana Roo: There are information gaps about the productive potential of smaller diameter trees. The first step for their use will be systematizing the information coming from forest inventories. For forests that are not commercially used evaluation of the forest potential is needed, since little information currently exists.
 - Market exploration, sales promotions, and product development for smaller diameter trees represent unavoidable steps to introduce these species and type of wood for sawing and specialty uses. For its use as chips and kindling the available technical information should be systematically collected and examined about use of biomass for energy production, and compared to current energy costs in the region (biomass vs natural gas or oil).
 - There are several critical areas that lack data. These include forest growth data, management systems, forestry operating costs, general aspects of administration and management, industry information, and product development. A “bench marking” study would be useful.
 - Estimation of volumes left behind after forestry extraction operations. It is important to estimate the volume of potential by-products left on the forest floor after extraction. The estimate should specifically include mahogany.
 - Technical studies of the following lesser-used species are required:
 - i. Petén: Adequate description of differences between **ramón blanco** (*Brosimum alicastrum*), **ramón oreja de mico** (*Brosimum costaricanum*) and **ramón colorado** (*Brosimum sp.*).
 - ii. Petén: Adequate description of the differences between **malerio colorado** (*Aspidosperma megalocarpon*) and **malerio blanco** (*Aspidosperma stegiomeris*).
 - iii. Petén: Description of the technological, esthetic, and machining characteristics of **tempisque** (*Masticodendron capari*), **jesmo** (*Lysiloma sp.?*), **matasano** (*Casimiroa edulis*), **luin hembra** (*Ampelocera hottlei*), **sacuché** (*Rehdera penninervia*), **manax** (*Pseudolmedia oxyphyllaria*), **luin macho** (*Drypetes brownii*) and **copó** (*Coussapoa oligocephala*). Due to the reduced number of species with significant volumes that remain to be described, it will not be necessary to set up a laboratory in Guatemala. It would be considerably more economical to conduct the technological studies in an existing laboratory in Central America, Mexico, or the United States, and saving money for a marketing promotion center instead.
 - iv. Atlántida: It’s recommended to establish an official list of species, with descriptions of their taxonomy and appearance, which would aid in determining species in forest inventories and in the sawing operations.
 - v. Atlántida: A description is needed of the technological, esthetic, and machining characteristics of **jigua** (*Nectandra hihua*) and **almendro** (*Albizia caribaea*).
- A critical and relevant point for all the recommendations above is establishing strong links between research results and the daily practices of decision-makers in forestry and the wood products industry.

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APPENDIX I

Glossary

Board feet	The basic unit of measure for sawn wood. One board foot is equal to a 1-inch board, 12-inches in width and 1-foot in length. A logical question is always: Full-sawn or nominal? Full-sawn means that a one-inch board is a full one-inch and may be slightly more, but never less. Nominal means that the actual size of the lumber is less and has been rounded-up.
Community forestry operation	A group formed in a community near or within a forested area to carry out joint activities of forest management and forest products marketing. Community forestry as used herein means that the forests are under control of a community operation, but not necessarily that the operation has get fully developed technical forestry practices.
Doyle	A log scaling system that tends to yield large over-run for smaller logs (i.e. more lumber than predicted using the log scale). It was developed in the late 1800s and is still commonly used in the hardwoods industry in the U.S. South and in Guatemala. The Doyle log scale rule assumes that logs are first squared into a cant by reducing the diameter by four-inches to allow for slabs and edgings. To allow for sawkerf and shrinkage, the cant volume is then further reduced by 25% (Briggs 1994, pp 23-25).
Edger or Edge trimmer	A machine used to saw larger pieces of squared-off wood, often called cants, into lumber. It usually consists of several circular saws in a row that can be manually or electronically set to regulate width of the boards sawn. This machine is usually located immediately after a larger saw (band or circular), which cuts a log into squared-off pieces that will fit into the edger.
Green markets	As used in this report, markets where forest products from well- managed forests, often certified by an independent third party, have a competitive advantage in terms of buyer preferences.
Heartwood	Wood in the inner part of the log, whose cell walls are impregnated with substances that heighten its resistance against rot. Heartwood generally is darker than the rest of the log (i.e. sapwood). The resistance and the esthetic characteristics of heartwood are favored by most hardwood lumber grading rules and for the surface layers of plywood used for higher-value products, such as furniture. This means that sapwood, which comprises anywhere from 20% to 60% or more of the log, often ends up as scrap.
Lesser-used species	Also called lesser-known species. Species whose (regional) forest potential is greater than its current use. The use of the term <i>lesser-used</i> instead of <i>lesser-known</i> species follows the rationale of the International Tropical Timber Organization, which states that knowledge about these species is no longer the most important problem to resolve to increase their use.
Maderero	This is basically a log trader. In Honduras, madereros deal with motorsawn boards and posts. Due to the specific characteristics in the forest sector, in each Latinamerican country the functions and situation of madereros vary. In Nicaragua and Costa Rica, they are strongly involved in extraction, while in Honduras and Petén, the trading function prevails. Until now, only the Guatemalan authorities have fully recognized the importance of madereros for forest products trade.
Mill run	The normal output of a sawmill, not sorted for grade or specific lengths or widths.

Motosierrista	Literally chainsawyer. Men that legally or illegally fell trees and saw the logs to boards or planks in the forest, either free-hand or with a guide (e.g. “Alaskan sawmill”). In a formal extraction team, it is the forest worker in charge of felling the tree.
Phenolchlorides	Key chemical in certain wood preservative treatments, such as pentachlorophenol (also known as penta). Not allowed in many countries. Its use is also against fsc standards.
Plywood core	This term normally refers to the interior layers of veneer in a sheet of plywood, and has been an important use for light- and medium-weight lesser-used species. Plywood core can also be a combination of veneer and lumber, or reconstituted wood.
Rate of recovery	The relation between the wood raw material input and output of a production line. For example, in a Mexican sawmill, the rate of recovery is determined by dividing the measured volume of boards, converted from Board Feet to cubic meters, by the incoming log scale volume (using either Smalian’s or Huber’s formula).
Sap Wood	See heartwood.
Scouting (muestreo)	The process of searching the forest for suitable trees for felling.
Secondary production	All production having sawn lumber or plywood as inputs (resawing is considered part of primary production in this case).
Siding	Lumber or panel products intended for use as an exterior wall covering, either horizontal or vertical.
Specific gravity	<p>The relation of specific density of a certain material and the specific density of water. All references in the text, unless stated otherwise, use the measurement of specific gravity based upon the weight of oven-dry wood and the volume of green wood. Specific gravity is a central physical characteristic of wood, which determines a number of other characteristics and is very important to narrowing-down potential uses for a species. In the text, three specific gravity categories have been chosen to classify wood:</p> <p>Light-weight species: Specific gravity below 0.4. These species generally are light in color, sensitive to rot, easy to work with, generally low-priced, and compete with pine. Often used for plywood production (especially core layers) or inexpensive furniture.</p> <p>Medium-weight species: Specific gravity between 0.4 and 0.65. Generally light or reddish color. Mahogany and its substitutes belong to this category. Good for furniture and interior applications.</p> <p>Heavy (-weight) species: Specific gravity above 0.65. Generally dark-colored, frequently attractive, and sometimes difficult to process. Used generally for flooring, and outdoor applications.</p>
Stack	Lumber or panel products piled in an orderly manner for drying or shipping. Proper lumber stacking requires use of stickers, which are wood strips of varying thicknesses, depending on whether the purpose is drying or shipping, and careful placement of the stickers.
Trim-end saw/ chop saw	Saw, usually circular, used to cut boards and lumber to correct lengths. A chop saw is used to primarily remove defect from pre-trimmed boards or lumber.
Veneer	A thin layer or sheet of wood. Veneer is commonly rotary-peeled (cut on a lathe) for commodity plywood products and plywood core (see above), but can also be made by sawing or, as is often the case in Mesoamerica, sliced with a large blade. Higher value species are often sliced for use in the visible or surface layer of a piece of plywood.

APPENDIX 2

Scientific and common names of important Mesoamerican species

Scientific name	Family	Nicaragua	Honduras	Guatemala	Belice	Mexico	SW
<i>Acalypha diversifolia</i>	Euphorbiaceae			Palo de sangre			
<i>Acer skutchii</i>	Acereceae					Alamo plateado, arce	
<i>Albizia caribaea</i>	Leguminosae	Guanacaste blanco	Almendo				
<i>Alchornea latifolia</i>	Euphorbiaceae					Cotón de caribe	
<i>Alnus acuminata</i>	Betulaceae					Aile	
<i>Alseis yucatanensis</i>	Rubiaceae			Son	Wild mamee	Papelillo	0.64
<i>Ampelocera hottlei</i>	Ulmaceae		Barremillo, Manteco, Vaca	Luin hembra	Bullhoof	Luin	0.66
<i>Anacardium excelsum</i>	Anacardiaceae	Espavel			Espave		0.40
<i>Andira inermis</i>	Leguminosae		Almendo del río	Almendo colorado	Angelin	Maquilla	
<i>Apeiba aspera/ Apeiba tibourbou</i>	Tiliaceae	Peine de mico/ Burillo/ Tapabotija					0.24
<i>Aspidosperma spruceanum</i>	Apocynaceae		Cañamito				0.53
<i>Aspidosperma megalocarpon*</i>	Apocynaceae	Ñambaro blanco		Malerio colorado	Mylady	Pelmax	0.78
<i>Aspidosperma stegomeres*</i>	Apocynaceae			Malerio blanco		Bayo	
<i>Astronium graveolens</i>	Anacardiaceae	Quitacalzón/Ronron	Ciruelillo, ronrón, gateado	Jobillo		Palo mulato, gateado	0.75
<i>Avicennia germinans</i>	Verbenaceae	Palo de sal					0.75
<i>Blepharidium mexicanum</i>	Rubiaceae					Popiste	
<i>Blomia prisca</i>	Sapindaceae			Tzol			
<i>Bombacopsis quinatum</i>	Bombacaceae	Pochote				Cedro espino	
<i>Brosimum alicastrum</i> (syn. <i>B. terrabanum</i>)	Moraceae	Ojoche	Masiquilla, masico, masica	Ramón blanco	Breadnut	Ramón	0.73
<i>Brosimum costaricanum</i>	Moraceae	Ojoche blanco		Ramón oreja de mico			0.73
<i>Brosimum sp</i>	Moraceae			Ramón			0.73

* The two *Aspidosperma* species are synonyms. The differences observed empirically (different heartwood color) that have led to different common names (**malerio blanco** - **malerio colorado** in Guatemala and **bayo** - **pelmax** in Mexico) could be due to a facultative heartwood development, but could also indicate the existence of subspecies.

Scientific name	Family	Nicaragua	Honduras	Guatemala	Belice	Mexico	SW
Bucida buceras	Combretaceae			Pucté	Bullet tree	Pucté	0.85
Bursera simaruba	Burseraceae	Jiñocuabo/Indio desnudo	Indio desnudo	Chacaj colorado		Chacah, chacah rojo	0.33
Byrsonima crassifolia	Malpighiaceae	Nancite					0.59
Byrsonima spicata	Malpighiaceae		Pepenance				0.44
Caesalpinia granadillo	Leguminosae				Partridge wood		
Caesalpinia velutina	Leguminosae	Mandagual, Aripin					
Calocarpum mammosum	Sapotaceae		Zapote	Zapote mamey			0.53
Calophyllum brasiliense	Clusiaceae	Santa María, María	Santa maría, María	Santa María		Bari	0.52
Calycophyllum candidissimum	Rubiaceae		Colorado, Salomo			Camarón	
Carapa guianensis	Meliaceae	Cedro Macho	Cedro macho		Bastard Mahogany		0.47
Carya ovata	Juglandaceae					Nogal motudo	
Cedrela odorata	Meliaceae	Cedro real	Cedro	Cedro	Cedar	Cedro Rojo	0.33
Ceiba pentandra	Bombacaceae	Ceiba	Ceiba	Ceiba		Ceiba	0.36
Cojoba arborea	Leguminosae		Barba de Jolote				0.61
Copaifera aromatica	Leguminosae	Camibar					0.62
Cordia alliodora	Boraginaceae	Laurel	Laurel blanco		Salmwood	Hormiguillo	0.44
Cordia bicolor	Boraginaceae	Muñeco					0.36
Cordia diversifolia	Boraginaceae			Roble			
Cordia dodecandra	Boraginaceae					Ziricote	
Cordia megalantha	Boraginaceae		Laurel negro				
Coussapoa oligocephala	Moraceae			Copo			
Cybistax donnell-smithii		<i>See Tabebuia donnell-smithii</i>					
Cymbopetalum penduliflorum	Annonaceae					Orejuelo	
Dalbergia retusa	Leguminosae	Ñambar/Cocobolo				Granadillo	0.80
Dalbergia stevensonii	Leguminosae			Rozul	Rosewood		
Dalbergia tucurensis	Leguminosae	Granadillo	Granadillo				0.53
Dendropanax arboreus	Araliaceae		Cuajada	Mano de león		Mano de danto/ Sac Chacah	0.41
Dialium guianense	Leguminosae	Comenegro, Tamarindo	Tamarindo silvestre, Paletto	Guapaque	Ironwood	Paque	0.85
Didymopanax morototoni	Araliaceae	Mano de león				Morototo/ Candelero	0.53
Dipholis salicifolia	Sapotaceae				Bustic		
Dipholis stevensonii	Sapotaceae					Guaité	

Scientific name	Family	Nicaragua	Honduras	Guatemala	Belice	Mexico	SW
<i>Dipteryx panamensis</i>	Leguminosae	Almendro					0.85
<i>Drypetes brownii</i>	Euphorbiaceae			Luin macho			
<i>Enterolobium cyclocarpum</i>	Leguminosae	Guanacaste	Guanacaste	Conocaste	Tubroos	Guanacastle, Parota	0.38
<i>Ficus involuta</i>	Moraceae			Amate			
<i>Ficus radula</i>	Moraceae			Chimon			
<i>Genipa americana</i>	Rubiaceae					Genipa	0.66
<i>Gliricidia cacahuananche</i>	Leguminosae					Cacahuananche	
<i>Gmelina arborea</i>	Verbenaceae	Melina					0.47
<i>Guaiacum sanctum</i>	Zygophyllaceae	Guayacan		Guayacán, lignum vitae		Guayacan	1.24
<i>Gordonia brandegeei</i>	Theaceae		Coloradito				0.64
<i>Guarea excelsa*</i>	Meliaceae			Cedrillo hoja grande			0.52
<i>Guarea glabra*</i>	Meliaceae		Carbón blanco		Cramantee	Cedrillo	
<i>Guarea tonduzii*</i>	Meliaceae			Cedrillo hoja pequeña			
<i>Gutteria anomala</i>	Annonaceae					Zopo	
<i>Gutteria leiophylla</i>	Annonaceae			Cedrillo			
<i>Guazuma ulmifolia</i>	Sterculiaceae	Guacimo de ternero				Pixoy	0.57
<i>Hieronyma alchorneoides</i>	Euphorbiaceae	Nanciton	Rosita, Nance de montaña			Urucurana	0.61
<i>Homalium racemosum</i>	Flacourtiaceae	Areno amarillo					0.74
<i>Huerteia cubensis</i>	Staphyleaceae		Cedrillo				0.37
<i>Hura crepitans</i>	Euphorbiaceae				Possum wood	Habillo	
<i>Hymenaea courbaril</i>	Leguminosae	Guapinol	Guapinol			Courbaril/ Guapinol	0.78
<i>Ilex skutchii</i>	Aquifoliaceae		San juan areno				
<i>Ilex tectonica</i>	Aquifoliaceae		San juan arena				0.46
<i>Inga edulis</i>	Leguminosae			Cushin			0.54
<i>Jacaranda copaia</i>	Bignoniaceae	Guachipilin	Jacaranda, zorra		Copaia	Samarapa	0.38
<i>Juglans olanchana</i>	Juglandaceae	Nogal	Nogal				0.40
<i>Lecythis sp.</i>	Lecythidaceae	Pansuba					
<i>Libocedrus decurrens</i>	Cupressaceae				Pencil Cedar		
<i>Licania platypus</i>	Chrysobalanaceae	Hoja tostada	Urraco	Sunza	Monkey Apple	Mesonzapote	0.58
<i>Liquidambar styraciflua</i>	Hamamelidaceae	Liquidambar	Liquidambar			Liquidámbar	0.49
<i>Lonchocarpus castilloi</i>	Leguminosae			Manchiche		Machiche	0.79

* The three cited *Guarea* species are synonyms, *G. glabra* being the most widely accepted name. However, the common names **cedrillo hoja grande** and **cedrillo hoja pequeña** could indicate the existence of subspecies.

Scientific name	Family	Nicaragua	Honduras	Guatemala	Belice	Mexico	SW
Lonchocarpus hondurensis	Leguminosae					Palo gusano, machiche	
Luehea seemanii	Tiliaceae		Guacimo Colorado			Yayo	0.52
Lysiloma acapulcensis	Leguminosae					Tepehuaje	
Lysiloma bahamensis	Leguminosae			Tzalam		Tzalam	
Lysiloma sp	Leguminosae			Jesmo			
Maclura tinctoria	Moraceae				Fustic	Mora	
Macrohasseltia macroterantha	Flacourtiaceae		Huesito, Tempisque				0.62
Magnolia schiedeana	Magnoliaceae					Magnolia	
Magnolia yoroconte	Magnoliaceae		Redondo, Yoroconte				0.52
Manilkara achras (syn. M. zapota)	Sapotaceae	Nispero	Chicle, Zapotillo, Nispero	Chicozapote		Sapodilla/ Chicozapote	0.85
Manilkara sp	Sapotaceae			Chiquibul			
Masticodendron capari	Sapotaceae			Tempisque			
Matayba oppositifolia	Sapindaceae			Zacuayum		Zacuayum	
Metopium brownei	Anacardiaceae			Chechen negro		Chechem, chechen negro	0.7
Minquartia guianense	Olaceae	Manu/Palo de piedra					0.75
Mirandaceltis monoica	Ulmaceae		Cenizo			Chicharra, rosadillo	0.7
Misanteca peckii	Lauraceae					Pimientillo	
Mortoniodeson anisophyllum	Tiliaceae		Barrenillo				0.37
Mosquitoxylum jamaicense	Anacardiaceae		Jucucua, San Juan pedrano			Pajulté	
Myroxylon balsamum	Leguminosae					Bálsamo	
Nectandra hihua			Jigua				
Ochroma pyramidale	Bombacaceae	Balsa/Guano/ Tambor					0.10
Ocotea caniculata	Lauraceae		Aguacatillo				
Ocotea lundellii	Lauraceae			Sosni			
Ocotea sp	Lauraceae			Sacalante			
Ocotea veraguensis	Lauraceae	Canelo					0.64
Orbignya cohune	Arecaceae			Corozo			
Ormosia sp.	Leguminosae	Carolillo/ Caroquillo					0.54
Ormosia toledoana	Leguminosae					Hormiga, colorín	

Scientific name	Family	Nicaragua	Honduras	Guatemala	Belice	Mexico	SW
Otoba novogranatensis	Myristicaceae						0.44
Ouratea luncens	Ochnaceae			Sierra			
Pachira aquatica	Bombacaceae			Zapote bobo	Provision tree	Apompo	0.51
Peltogyne pubescens	Leguminosae				Amaranth		
Pentaclethra macroloba	Leguminosae	Gavilan					0.54
Persea americana	Lauraceae		Aguacate, Anise			Aguacate	
Pimenta diodica	Myrtaceae			Pimienta			0.86
Pinus caribaea	Pinaceae	Pino					0.43
Pinus maximinoi	Pinaceae	Pino					0.43
Pinus oocarpa	Pinaceae	Pino	Pino				0.55
Pinus patula/tecunumanii	Pinaceae	Pino					0.57
Piscidia communis	Leguminosae					Jabin	
Pithecellobium arboreum	Leguminosae	Quebracho	Barba de jolote	Cola de coche		Barba jolote, frijolillo	0.65
Pithecellobium leucocalyx	Leguminosae			Guaciban	Red Fowl	Guacibán	0.52
Pithecellobium saman	Leguminosae	Genizaro/Cenizaro	Carreto, Cenicero				0.53
Platymiscium dimorphandrum	Leguminosae	Machimbo, hormigo, Palo de marimba, Toncontín	Hormigo				0.69
Platymiscium pinnatum (syn. P. polystachyum)	Leguminosae	Coyote			Palo santo	Panama Rosewood	0.58
Platymiscium yucatanum	Leguminosae					Granadillo	
Podocarpus guatemalensis	Podocarpaceae		Ciprés				
Poulsenia armata	Moraceae					Masamorro	
Pouteria amygdalina	Sapotaceae			Silion			0.72
Pouteria campechiana	Sapotaceae			Caniste		Kaniste	0.78
Pouteria izabalensis	Sapotaceae		Celillón				0.71
Pouteria mayeri	Sapotaceae			Zapotillo hoja fina			
Pouteria sp	Sapotaceae	Zapotillo		Zapotillo			0.85
Prioria copaifera	Leguminosae	Kativo/Cativo					0.45
Prosopis juliflora	Leguminosae					Mesquite	
Protium copal	Burseraceae			Copal			
Protium panamense	Burseraceae	Alcanfor					0.45
Pseudobombax ellipticum	Bombacaceae			Amapola		Amapola	0.35
Pseudolmedia oxyphyllaria	Moraceae			Manax			

Scientific name	Family	Nicaragua	Honduras	Guatemala	Belice	Mexico	SW
<i>Pterocarpus hayesii</i>	Leguminosae		Sangre blanco			Palo de sangre	0.45
<i>Pterocarpus officinalis</i>	Leguminosae	Sangregrado blanco					0.36
<i>Pterocarpus</i> sp.	Leguminosae	Sangregrado		Sangre			0.45
<i>Quararibea funebris</i>	Bombacaceae					Molinillo, molenillo	
<i>Quercus</i> sp.	Fagaceae				Oak	Encino, Roble	
<i>Quercus skinneri</i>	Fagaceae		Bellota, roble de montaña		Oak	Encino	
<i>Rehdera penninervia</i>	Verbenaceae			Sacuche	Oak	Encino	0.75
<i>Rheedia edulis</i>	Clusiaceae	Joco mico					
<i>Rhizophora harrisonii</i>	Rhizophoraceae	Mangle rojo					0.86
<i>Rollinia microcephala</i>	Anoonaceae			Sufricay			
<i>Roseodendron donnell-smithii</i>		See <i>Tabebuia donnell-smithii</i>					
<i>Sacoglottis trichogyna</i>	Humiriaceae	Rosita/Manteco					0.72
<i>Schizolobium parahybum</i>	Leguminosae		Tambor, zorra	Plumajillo	Quamwood	Picho	
<i>Schoepfia vacciniiflora</i>	Olacaceae	Areno blanco					0.47
<i>Sebastiania longiscuspis</i>	Euphorbiaceae			Chechen blanco		Chechem blanco	0.51
<i>Sickingia salvadorensis</i>	Rubiaceae			Saltemuche		Chacahuanté	0.6
<i>Simarouba amara</i> *	Simaroubaceae	Aceituno	Negrito	Aceituno			0.38
<i>Simarouba glauca</i> *	Simaroubaceae	Aceituno	Aceituno, Negrito, Negritón	Pasaque hembra		Negrito, Pasa-ak	0.35
<i>Spondias mombin</i>	Anacardiaceae		Jocote, Jobo	Jobo	Hogplum	Jobo	0.39
<i>Sterculia apetala</i>	Sterculiaceae	Panama				Bellota	0.33
<i>Swartzia cubensis</i> **	Leguminosae			Llora sangre		Corazón azul, Katalox	0.78
<i>Swartzia lundellii</i> **	Leguminosae			Catalox			
<i>Sweetia panamensis</i>	Leguminosae		Bilihuete, Chichipate	Chate, Chichipate	BillyWebb	Chakté	0.79
<i>Swietenia humilis</i>	Meliaceae	Caoba del pacífico					0.71
<i>Swietenia macrophylla</i>	Meliaceae	Caoba	Caoba	Caoba	Mahogany	Caoba	0.45
<i>Symphonia globulifera</i>	Clusiaceae	Leche Maria	Amarillo, Barillo Varillo		Waika chewstick		0.56
<i>Tabebuia donnell-smithii</i>	Bignoniaceae		San Juan Guayapeño	Palo Blanco		Primavera	
<i>Tabebuia guayacan</i>	Bignoniaceae	Cortez	Cortez				0.85
<i>Tabebuia rosea</i>	Bignoniaceae	Roble/Macuelizo	Macuelizo, Roble de sabana			Apamate, maculis	0.57

* Some sources cite both *Simarouba* species as synonyms.

** The cited *Swartzia* species are synonyms, *S. cubensis* being the most widely accepted. However, the common names **llora sangre** y **catalox**, discerned by locals in Guatemala, could indicate the existence of subspecies.

Scientific name	Family	Nicaragua	Honduras	Guatemala	Belice	Mexico	SW
Talauma mexicana	Magnoliaceae					Jolmashte, pirinola	
Talisia floresii	Sapindaceae			Coloque			0.86
Talisia olivaeformis	Sapindaceae			Guaya		Guaya	0.89
Tapirira guianensis	Anacardiaceae		Piojo			Southern wild mahogany	0.42
Tectona grandis	Verbenaceae	Teca					0.57
Terminalia amazonia	Combretaceae	Guayabon	Cumbillo, Guayabillo	Canchan		Nargusta canshán	0.66
Terminalia sp	Combretaceae	Guayabo negro, Guayabo de charco					0.51
Tetragastris panamensis	Burseraceae	Kerosen	Kerosen				0.70
Trattinickia sp	Burceraceae	Caraño					0.41
Vatairea lundellii	Leguminosae	Mora	Amargoso	Danto	Bitterwood	Amargoso	0.62
Virola koschnyi	Myristicaceae	Sebo/Banak colorado	Sangre Real			Banak	0.36
Virola sebifera	Myristicaceae	Sebo/Banak blanco					
Vitex gaumeri	Verbenaceae	Bimbayan		Yaxnik	Fiddlewood	Ya-axnik	0.52
Vochysia ferruginea	Vochysiaceae	Manga Larga/ Zopilote/botarrama	San Juan Colorado				0.38
Vochysia guatemalensis	Vochysiaceae		San Juan peludo				0.41
Vochysia hondurensis	Vochysiaceae	Palo de Agua	San Juan peludo, San Juan blanco, San Juan de la costa	San Juan		Yemeri, Maca blanca	0.34
Vochysia jefensis	Vochysiaceae		San Juan Rojo				0.44
Wimmeria bartletti	Celastraceae					Chintoc	
Zanthoxylum beliziense	Rutaceae		Cedro espino, Teta	Lagarto	Prickly Yellow	Lagarto	0.43
Zanthoxylum elephantiasis	Rutaceae			Naranjillo			
Zanthoxylum sp.	Rutaceae	Chinche/Lagarto					0.51
Zuelania guidonia	Flacourtiaceae	Pellejo de vieja		Tamay		Trementino	0.65

APPENDIX 3

Promising lesser-used woods of Mesoamérica*

LIGHT-AND MEDIUM-WEIGHT SPECIES

Species	Processing problems	Strengths	Market demand/Actual uses	Potential uses	Citation
<i>Anacardium excelsum</i> Espavel (Nica) SG: 0.40 ^{FN} DC: low ^{FN}	General workability is poor, except moulding, which is easy and good	This wood can take a beating, can be used as cement forms for roof construction more often (4 to 5 times) than pine (only 1 to 2 times)	Little demand/considered commercial in Costa Rica	Construction, inexpensive furniture	FN WW TT
<i>Aspidosperma spruceanum</i> Cañamito (Hon) SG: 0.53 ^{CH} DC: low ^{CH}	None	Easy to saw	Little demand/cabinetry	Construction	CH DH TT
<i>Bursera simaruba</i> Chacá (Mex) Chaca colorado (Guate) SG: 0.33 ^{GK} DC: low ^{ME}	Susceptible to fungi	Good workability, certain fungi add character to the grain	Steady demand below forest potential/used in Mexico and Guatemala for plywood and some inexpensive furniture	Construction, cement forms for roof construction, siding, inexpensive furniture, boxes, pallets	WW ME TT
<i>Byrsonima spicata</i> Pepeñance (Hon) SG: 0.44 ^{PS} DC: low ^{PS}	None	Light-brown heartwood	Little demand/general cabinetry	Carpentry, boxes, door and window frames	PS TT
<i>Calophyllum brasiliensis</i> Santa María (Guate and Nica); María (Hon) SG: 0.56 ^{CU} DC: medium ^{FN}	Moderately difficult to work because of cross grain and hardness, difficult to dry	Heartwood color is reddish chestnut, very similar to mahogany, can substitute directly for mahogany	Good demand below or near forest potential/cabinetry in general, as substitute for mahogany, plywood, construction	Doors, windows, veneer, staircase tread, handrails	CU CH FN WW TT
<i>Carapa guianensis</i> Cedro Macho (Hon y Nica) SG: 0.52 ^{FN} DC: medium ^{FN}	None	Easy to work, color very similar to mahogany	Demand is increasing rapidly in Nicaragua as direct substitute for mahogany, sometimes being already locally overused	Doors, windows, cabinets, in general, all the uses for mahogany	FN WW TT
<i>Ceiba pentandra</i> Ceiba (all regions) SG: 0.30 ^{FN} DC: medium ^{FN}	Very soft wood with coarse texture	Wide potential board dimensions, color and grain pattern (rays in tangential view) very similar to beech (<i>Fagus silvatica</i>)	Little demand for plywood	Boxes, toys, siding, decorative veneer (could be potential plantation species)	FN TT
<i>Cojoba arborea</i> Barba de Jolote (Hon) SG: 0.61 ^{CH} DC: low ^{CH}	Moderately easy to work because of cross grain and lateral hardness	Very durable, attractive color and grain	Little demand/fine furniture	Handles for tools and sporting equipment	CH PS FN
<i>Cordia alliodora</i> Laurel negro (Hon) Laurel (Nica) SG: 0.44 ^{FN} DC: medium ^{FN}	None	Attractive heartwood color (light-brown with darker stripes)	High demand near forest potential (species often grows in pasture land)/carpentry, cabinetry, fine furniture, cabinets	Turnings, flooring, veneer, plywood, gunstocks, light construction, interior finishing	CH FN WW TT

Species	Processing problems	Strengths	Market demand /Actual uses	Potential uses	Citation
<i>Dendropanax arboreus</i> Sacchacá (Mex) Mano de León (Guate) SG: 0.40 ^{TT} DC: low ^{ME}	Susceptible to sap stain	Excellent technical substitute for mahogany, has no taste	Steady demand below forest potential/ Tongue suppressors, plywood and furniture	Siding, furniture, furniture frames, upholstery frames, and toothpicks	ME WW TT
<i>Ficus sp.</i> Higo (Mex) Amate (Guate) SG: aprox. 0.45 (estimate) DC: no data	Extremely sensitive to sap stain, texture is very coarse and porous	Wide dimensions possible, rapid growth, interesting grain pattern	No current demand	Furniture with large dimensions, inexpensive furniture. As with many other light-weight species, more effective and economic treatments to prevent sap stain are needed	
<i>Guarea grandifolia</i> Marapolán (Hon) SG: 0.56 ^{CU} DC: low ^{CU}	None	Durable	Moderate demand/ Fine furniture, doors, windows	Decorative veneer, residential flooring, general carpentry	CH CU WW TT
<i>Hieronyma alchorneoides</i> Rosita (Hon) Nancitón (Nica) SG: 0.63 ^{CU} DC: medium ^{CU}	Cross grain slightly affects workability, color changes with exposure to sun	Very attractive violet heartwood, but color changes with exposure to sun to reddish-brown	Little demand for carpentry work	Cabinets, decorative veneer, window and door frames, staircase tread, handrails, flooring	CH CU FN PS WW
<i>Huerteia cubensis</i> Cedrillo (Hon) SG: 0.37 ^{CU} DC: low ^{CU}	None	Attractive color, easy to work, light weight	Little demand/furniture	Doors, windows, cabinets, veneer, moldings	CU CH WW
<i>Ilex tectonica</i> San Juan Areno (Hon) SG: 0.46 ^{PS} DC: medium ^{PS}	Susceptible to sap stain	Very easy to work	High demand for furniture, interior cabinetry, technical substitute for mahogany (normally stained)	Flooring, stair tread, handrails, door frames	CH FN PS
<i>Licania platypus</i> Sunza (Guate) SG: 0.58 ^{GK} DC: low ^{ME}	Coarse texture, high silica content	Pronounced grain pattern due to cell structure, easy to plane	No current demand	Flooring, inexpensive furniture	ME GK TT
<i>Lysiloma bahamensis</i> Tzalam (Mex, Guate) SG: 0.63 ^{TT} DC: medium ^{ME}	Tannins cause dark stains in contact with iron hardware and fasteners	Easy to work, attractive walnut color, significant volumes in Mexico and Guatemala	Growing demand, still below forest potential / Flooring and furniture	Beams, posts, framing, doors, handrails	ME TT
<i>Macrohasseltia macroterantha</i> Tempisque, Huesito (Hon) SG: 0.62 ^{CU} DC: medium ^{CU}	Moderately difficult to machine due to cross grain and hardness	Attractive whitish-rose color	Moderate demand below forest potential / Interior cabinetry and general carpentry	Heavy construction, residential and industrial flooring, beams, railroad crossties, tool handles	CH CU FN
<i>Magnolia yoroconte</i> Redondo (Hon) SG: 0.52 ^{CU} DC: low ^{CU}	None	Easy to work and dry	High demand, partially over forest potential / General cabinetry	Residential flooring, decorative veneer	CH CU FN WW

Specie	Processing problems	Strengths	Market demand /Actual uses	Potential uses	Citation
<i>Pentaclethra macroloba</i> Gavilán (Nica) SG: 0.54 ^{FN} DC: medium ^{FN}	None known	Attractive color	Little commercial demand	Flooring, decorative veneer, turnings	FN
<i>Pithecellobium arboreum</i> Quebracho (Nica) SG: 0.59 ^{FN} DC: ?	Sometimes planes poorly	Versatile, attractive heartwood color, easy to work	Steady demand by artisans, furniture, flooring	Wide range of potential uses	ME WW
<i>Pithecellobium saman</i> Genízaro (Nica) SG: 0.53 ^{FN} DC: low ^{FN}	Sometimes fuzzy grain	Clear brown color, versatility	Moderate demand (widely used in Costa Rica) / Furniture, pallets	Wide range of potential uses, with the potential for higher value uses	FN WW TT
<i>Platymiscium sp.</i> Coyote (Nica) SG: 0.58 ^{FN} DC: medium ^{FN}	Unknown	Normally easy to work with good result, attractive color and streaking grain pattern	Steady demand from artisans / Furniture and flooring	Artisan products, musical instruments, decorative veneer, flooring	FN TT
<i>Podocarpus oleifolius</i> Ciprés de montaña (Hon) SG: 0.53 ^{PS} DC: low ^{PS}	None	Easy to dry, straight grain, and fine texture	Little demand / Furniture	Parquet flooring, plywood, general carpentry	CH PS TT
<i>Pseudobombax ellipticum</i> Amapola (Mex y Guate) SG: 0.35 ^{ME} DC: medium ^{ME}	Very soft and susceptible to insects and fungi	Reddish light-brown color that some people like and others not, wide board dimensions possible, interesting pattern due to parenchyma bands in darker color, difficult to distinguish from mahogany when stained	Steady demand below forest potential / Used in Mexico and Guatemala for plywood, regional use in inexpensive furniture, interior door parts, and as a low quality substitute for mahogany	Furniture in which its larger potential dimensions are useful, siding, packing crates, pallets (steaming trials might reveal other product possibilities because of color changes)	ME GK WW
<i>Sickingia salvadorensis</i> Chactekoc (Mex) SG: 0.52 ^{TT} DC: high ^{ME}	Splits easily, color change from intense rose to a somewhat opaque honey, low saw yield, high sapwood percentage	Outstanding carving characteristics due to fine texture, excellent planing, sanding, and finishing characteristics, wood remains cherry color in shade, sapwood is yellow, over time, both sapwood and heartwood acquire the same color (opaque honey), sapwood is pretty resistant to insects and fungi	Little demand / Has been successfully exported, major barrier to increasing use is high price derived from its low sawing yield	Furniture, artisan products, and moldings (studies are needed to determine methods to reduce color changes)	ME TT
<i>Simarouba glauca</i> Pasa'ak (Mex) SG: 0.38 ^{TT} DC: medium ^{ME}	Sensitive to fungi that change the color of the wood	Easy to work	Little demand / Inexpensive furniture	Wide range of potential uses, from construction uses to kitchen articles	ME TT
<i>Spondias mombin</i> Jobo (Mex , Guate y Nica) SG: 0.40 ^{GK} DC: low ^{ME}	Sensitive to fungi that change the color of the wood	Versatile wood for "inferior" uses	Little demand / Used for plywood	Wide range of potential uses, from construction to siding, furniture, kitchen accesories, and boxes	ME GK WW TT
<i>Symphonia globulifera</i> Varillo, Amarillo Barillo (Hon) Leche María (Nica) SG: 0.56 ^{CU} DC: low ^{CU}	None	Attractive grain and is easy to work, wood is economical and suited for general carpentry, windows, doors, plywood	Moderate demand / General cabinetry, indoor and outdoor, plywood, sawn construction lumber	Decorative veneer, doors, windows, heavy constructions, beams, flooring, and tool handles	TT CU FN PS WW

Species	Processing problems	Strenghts	Market demand /Actual uses	Potential uses	Citation
<i>Tapirira guianensis</i> Plojo (Hon) SG: 0.42 ^{CU} DC: low ^{CU}	Gum in the wood sometimes makes processing difficult	Attractive reddish-brown heartwood	Some demand because similar color to mahogany / Furniture or furniture parts, and door parts	Cabinets, profiles, moldings	CH CU
<i>Terminalia amazonia</i> Cumbillo, Guayabillo Naranjo (Hon) SG: 0.62 ^{CU} DC: low ^{CU}	Moderately difficult to work because of raised, cross, and sometimes wavy grain, and medium hardness	Some people think the grain pattern and color are very attractive (reddish stripes on greenish background), durable	Moderate demand / Exterior and interior cabinetry	Heavy construction, agricultural tool handles, veneer, and sports equipment	TT CU PS FN WW
<i>Vitex gaumerii</i> Ya'axnic (Mex) SG: 0.52 ^{GK} DC: medium ^{ME}	Very poor log form results in low sawing yield	Very good working properties	No current uses	Tool handles	ME GK TT
<i>Vatairea lundellii</i> Danto (Guate) SG: 0.62 ^{GK} DC: medium ^{ME}	Coarse texture, saw dust affects many workers	Some like its greenish color, parenquim bands lead to a distinctive pattern when cut tangentially	Sporadic in-country demand for flooring	Construction, siding, flooring, railroad crossties	ME GK
<i>Virola koschnyi</i> Sangre (Hon y Guate) Sebo/ Banak (Nica) SG: 0.41 ^{CU} DC: low ^{CU}	Very sensitive to termite attack	Heartwood is attractive pale –to pinkish– brown, good molding properties	Consistent demand below or near forest potential / Veneer, inexpensive furniture, cabinets, moldings, and picture frames	Boxes, matches, molding	CH CU FN WW TT
<i>Vochysia ferruginea</i> San Juan Colorado (Hon) Zopilote (Nica) SG: 0.38 ^{FN} DC: high ^{FN}	Difficult to dry and not durable	Heartwood is attractive rose to pale brown, very easy to process	Little demand for general carpentry / Inexpensive furniture, veneer, plywood	Cabinets, profiles, moldings, furniture, and general carpentry	CH PS FN WW
<i>Vochysia hondurensis</i> San Juan Peludo (Hon) Palo de Agua (Nica) SG: 0.34 ^{FN} DC: medium ^{FN}	Difficult to dry	Heartwood is attractive pale brown	Little demand and not found in managed areas / Inexpensive furniture, cabinets, plywood	Confection handles, toothpicks, fruit packing boxes	CH PS FN WW
<i>Vochysia jafensis</i> San Juan Rojo (Hon) SG: 0.44 ^{PS} DC: low ^{PS}	None	Easy to work, attractive bright reddish color	Little demand / General cabinetry, light construction, cabinets	Veneer, boxes, moldings, general carpentry	CH PS
? Granadillo Rojo (Hon) SG: 0.53 ^{CH} DC: ?	Moderately easy to work	Heartwood is strong reddish-orange and has pronounced grain	Little demand / Fine turnings, fine furniture	Carved doors, handles and handicrafts	CH
? Manchado (Hon) SG: 0.61 ^{CH} DC: low ^{CH}	None	Fine texture and high luster	Little demand / Columns, beams, flooring	Bridges, parquet flooring, plywood, rustic stake furniture	CH
? Vaca, Barrenillo, Manteco (Hon) SG: 0.37 ^{CH} DC: low	Very sensitive to blue stain and insects	Very easy to work	Low demand / Inexpensive furniture that is treated	Cabinets, toothpicks, confection handles, fruit packing boxes	

HEAVY-WEIGHT SPECIES

Species	Processing problems	Strengths	Actual demand / Uses	Potential uses	Literature
<i>Ampelocera hottlei</i> Luin hembra (Guate) SG: 0.66 ^{GK} DC: medium ^{ME}		Outstanding processing characteristics for its high specific gravity	No current demand	Construction, window and door frames, flooring, tool handles, artisan products	ME GK
<i>Aspidosperma megalocarpon</i> Malerio colorado/ blanco (Guate) Bayo/Pelmax (Mex) SG: 0.78 ^{GK} DC: medium ^{ME}	Tendency to split, some uncertainty about the difference between malerio blanco and malerio colorado	Good workability for its specific gravity, bright brown color	Incipient demand in foreign markets	Non-structural interior uses, such as frames, railings, stair tread, tool handles, artisan products	ME GK TT
<i>Astronium graveolens</i> Jobillo (Guate) Quita calzón (Nica) SG: 0.75 ^{TT} DC: low ^{ME}	Tendency to split	Very attractive grain and color, (reddish yellow to reddish brown with darker stripes), good wood for carving, good workability	High demand for sawn wood used for furniture and artisan products	Flooring, decorative veneers, high-quality furniture, artisan products	FN WW TT
<i>Brosimum alicastrum</i> Ramón (Mex/ Guate) Masica (Hon) Ojoche (Nica) SG: 0.73 ^{GK} DC: low to medium ^{ME}	Very sensitive to fungi attack (tree very seldom develops a heartwood), high silica content, drying problems reported	Large volumes in the forests, bright cream color, interesting grain, near branches is rose colored, fine grain, excellent for turning	Little demand / Incipient demand for floors, used for plywood	Flooring, tool handles, rafters and beams, non-structural lumber, furniture (note: there may be concern about commercializing this species because of its use as a food source for animals, and at times, for humans)	GK ME FN WW TT
<i>Bucida buceras</i> Pucté (Mex y Guate) SG: 0.85 ^{GK} DC: high ^{ME}	Difficult to dry (twists and bends)	Greenish color resembles <i>Sweetia panamensis</i> and is attractive to many people (although some do not like it), crossgrain seen by quarter-sawing makes it look "lively"	Little demand	Flooring, heavy construction, railroad crossties	WW GK ME TT
<i>Caesalpinia platyloba</i> Chakteviga (Mex) SG: ? DC: ?	With sunlight, color changes from orange or reddish to a rather dull beige	High lateral hardness, high natural durability	Little demand / Small diameter logs (less than 25 cm) are sold as posts for rustic tourist structures	Flooring, tool handles	
<i>Chlorophora tinctoria</i> Mora (Nica) SG: 0.88 ^{FN} DC: low ^{TT}	None known	High lateral hardness, color golden yellow to red	Incipient demand for construction (plywood manufacturers use species they call "mora", but that most probably is not identical with <i>Chlorophora</i>)	Heavy construction, posts, bridges, railroad crossties, furniture	FN WW TT
<i>Dialium guianense</i> Come Negro (Nica) SG: 0.72 ^{FN} DC: medium ^{FN}	High silica content, difficult to work		Demand for construction (principally for posts)	Heavy construction, marine construction, railroad crossties, posts, fence palings, structural exterior construction	FN WW TT

Specie	Processing problems	Strenghts	Actual demand / Uses	Potential uses	Literature
<i>Dipteryx panamensis</i> Almendo (Nica) SG: 0.85 ^{FN} DC: high ^{FN}	Difficult to process, sometimes has fuzzy grain		Incipient demand for construction, commercial species in Costa Rica	Heavy construction, railroad crossties, tool handles, truck platforms and truck stake sides	FN
<i>Genipa americana</i> Jagua (Hon) SG: 0.66 ^{WW} DC: medium ^{WW}	Relatively easy to work	Attractive reddish-brown heartwood	Little demand, cabinetry, carpentry, boxes, wire / cable spools	Construction, tool handles, door and window frames	CH PS WW TT
<i>Gordonia brandegeei</i> Coloradito (Hon) SG: 0.65 DC: medium	Relatively easy to work	Rather high natural durability	Little demand / Heavy construction	General carpentry	PS WW
<i>Hymenaea courbaril</i> Guapinol (Nica) SG: 0.78 ^{FN} DC: medium ^{FN}	Unfavorable dimensional stability	Attractive grain and color (reddish-brown)	Demand near or over forest potential / Commercial flooring, exterior furniture	Decorative items / Artisan products, heavy construction, outdoor uses, boat and ship construction	FN WW TT
<i>Lonchocarpus castilloi</i> Machiche (Mex y Guate) SG: 0.79 ^{GK} DC: medium ^{ME}	In some regions, wood tends to be brittle and breaks easily	Very attractive grain and color, acquires silvery patina when outdoors	Steady demand below forest potential / Flooring, furniture	Tool handles, artisan products, exterior construction	GK ME TT
<i>Manilkara achras</i> Chicle, níspero (Hon y Nica) Chicozapote (Mex) Chico (Guate) SG: 0.85 ^{TT} DC: medium ^{FN}	Splitting is a problem with dried wood, wood is frequently damaged due to earlier chicle tapping	Generally straight grain, attractive color, finishes well	Little demand / Columns, roof beams, posts, construction walls, fine furniture, general carpentry, flooring	Marine constructions, tool handles, molding, handicrafts and novelties	FN CH ME TT
<i>Metopium brownei</i> Chechén (Mex) SG: 0.74 ^{ME} DC: medium ^{ME}	Reduced heartwood yield due to high percent of sapwood, planing problems due to curly fiber	Very attractive wood with variable colors (brown, reddish, greenish), finishes well, interesting sapwood, although it is sensitive to insects and fungi	Increasing demand still under forest potential / Flooring, expensive furniture	Artisan products, sapwood can be used for furniture (need to find uses for sapwood)	ME
<i>Piscidia communis</i> Jabín (Mex) SG: 0.74 ^{ME} DC: medium ^{ME}	Fiber tends to break, leaving small holes when planed	High natural durability, beige color with veins due to parenquima bands	No major current use, other than posts	Flooring, tool handles, artisan products	ME
<i>Pouteria izabalensis</i> and <i>P. amygdalina</i> Silión (Guate) Celillon (Hon) SG: 0.68 ^{WW} DC: ?	High silica content, unattractive reddish brown color, strong tendency to split during drying	Natural durability, plentiful in forest	Little demand / Heavy construction, railroad crossties	Industrial flooring, roof beams, tool handles, coal	PS WW
<i>Sacoglottis trichogyna</i> Rosita (Nica) SG: 0.72 ^{FN} DC: high ^{FN}		Attractive dark reddish brown color	Incipient demand for flooring	Structural interior and exterior uses, flooring, railroad crossties	FN

Species	Processing problems	Strengths	Actual demand / Uses	Potential uses	Literature
<i>Swartzia cubensis syn. Lundelii</i> Katalox (Mex) Llorasangre (Guate) SG: 0.86 ^{GK} DC: medium ^{ME}	Reduced heartwood yield, planing problems when blades are not perfectly sharp	Heartwood nearly black violet, has been proposed as a substitute for ebony, strong contrast between heartwood and sapwood is interesting	Little demand / flooring	Artisan products, high quality furniture, tool handles (Need to find uses for sapwood)	GK TT
<i>Tabebuia guayacan</i> Cortez (Nica) SG: 0.85 ^{FN} DC: high ^{FN}		Attractive color, veined grain	Consistent demand for flooring, furniture, and artisan products	Interior and exterior structural uses, marine uses, high-end furniture	FN TT
<i>Tetragastris panamensis</i> Kerosén (Nica) SG: 0.70 ^{FN} DC: high ^{FN}			Incipient demand, some manufacturers know a less heavy "Kerosén"	Interior and exterior uses, marine uses, railroad crossties, flooring	FN TT

* This list was compiled based on two independent criteria: available volume and potential uses. For a detailed description of technological and other characteristics of these species, please refer to the publications cited.

The vernacular names used are the ones most commonly used in the countries cited (Guate = Guatemala, Hon = Honduras, Mex = Mexico, Nica = Nicaragua). "Actual uses" refers to the countries cited.

SG = Specific gravity (oven dry to green volume)

DC = Dimensional change. The classification of the publication cited is provided.

Information is cited from the following publications:

ME- Echenique/ Plumtre (1994)

PS - Prospect (database)

CU - Boletines técnicos CUPROFOR (n.d.)

GK - Kukachka (1968)

DH - Manual de Dendrología

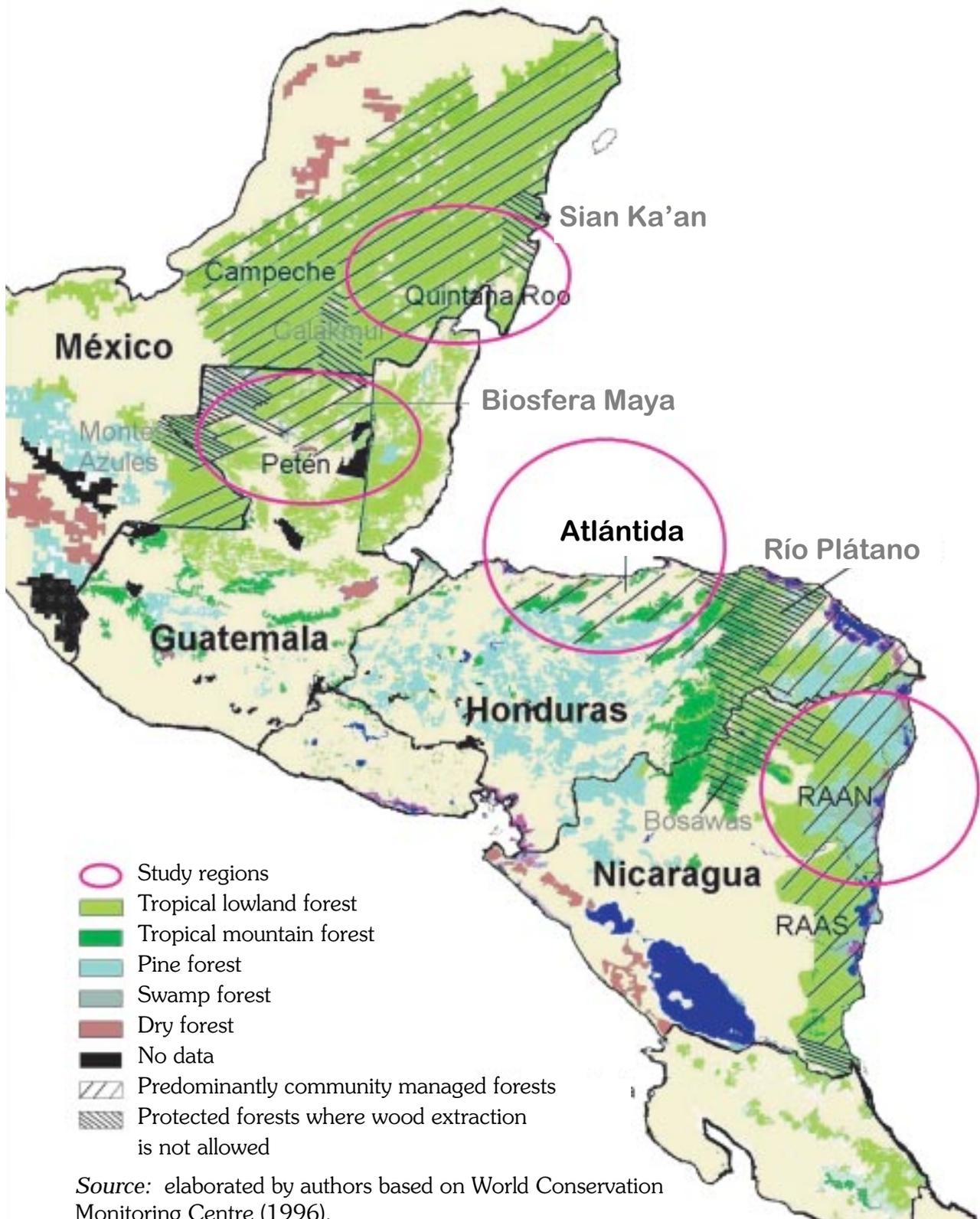
WW - Woods of the World (database)

FN- Fichas técnicas de maderas nicaragüenses. Alvear (1992 a 1994)

CH - Catálogo de 100 especies forestales de Honduras

TT - Chudnoff (1984) / U.S. Forest Service, Forest Products Laboratory Database

Study regions



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